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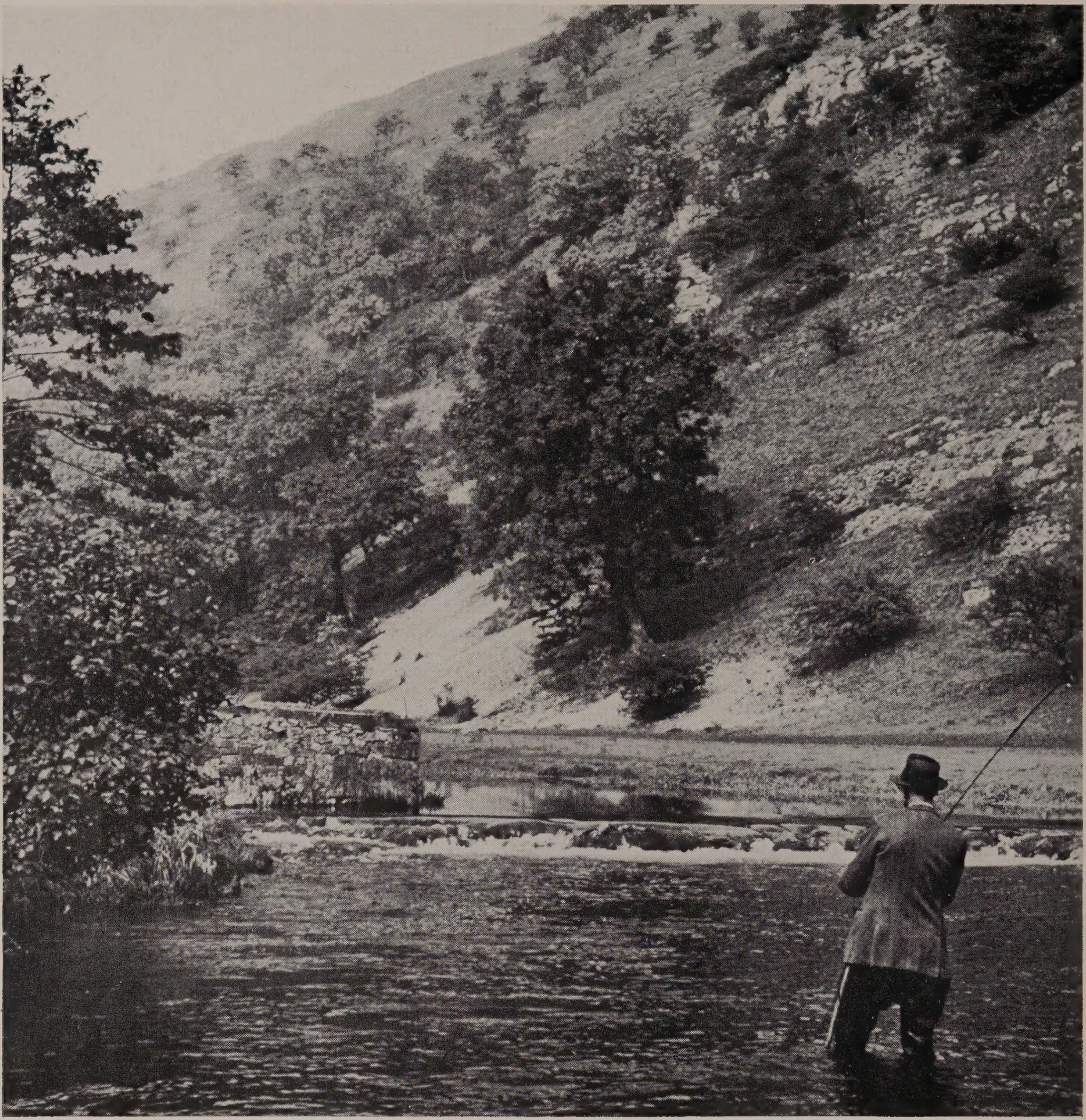
CLEAN AIR YEAR BOOK

1971-1972

National Society for Clean Air

60p



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CLEAN AIR YEAR BOOK
1971—1972

Contents

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GENERAL INFORMATION SECTION

Clean Air Progress	3
Air Pollution Research Programme in U.K.	4
The Warren Spring Laboratory	18
The Central Electricity Generating Board	19
The Atomic Energy Research Establishment	20
The Medical Research Council's Air Pollution Research Unit	21
The International Union of Air Pollution Prevention Associations	23
The Law Relating to Air Pollution	25
The Ringelmann Chart	43
National Industrial Fuel Efficiency Service	44
The Cost of Air Pollution	46
The History of Air Pollution in Great Britain	47
The Clean Air Case	48
British Standards Relating to Air Pollution	45
Recent Books, Papers and Reports	50
Films and Filmstrips	51
Smoke Control Areas	53
Major Smog Disasters	59
Directory of Organizations	60
Estimates of Air Pollution in the U.K.	63
Guide to Publications	65

N.S.C.A. SECTION

NSCA Officers, Council and Staff	69
NSCA List of Members	71
Information About the Society	77
Services to NSCA Members	78
Divisional Reports	79
Trade Directory and Buyers' Guide	85

INDEX TO ADVERTISERS

F. E. Beaumont Ltd.	96
Buell Ltd.	2
Clarke Chapman—John Thompson	24
Coalite & Chemical Products Ltd.	cover ii
Edwin Danks & Co. (Oldbury) Ltd.	cover iii
W. H. Dean & Son Ltd	97
Electricity Council	70
Incinerator Company Ltd.	cover iv
Modern Air Systems Ltd.	49
Nailsea Engineering Co. Ltd.	99
National Coal Board	98
National Carbonising Co. Ltd.	17
Rolfite Company	64
Solid Smokeless Fuel Federation	16
Western Precipitation	95
Diana Wyllie Ltd.	64

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Clean Air Progress

A Review for 1970/71

In attempting to review progress in clean air for the past 12 months, one is reminded of the sort of remark that often appears on a child's report from school: "Progress has been maintained, but with a little more interest and effort more could have been achieved".

Undoubtedly, during the period under review, much has been achieved in the realm of the environment. 1970 was, of course, European Conservation Year and there is no doubt that the publicity that this received did serve to awaken interest in the environment and, indeed, in clean air. How lasting this interest will be, remains to be seen. Some of it will die away rather quickly, but it is to be hoped that among more thinking people a real interest will remain which will result in things actually getting done. A lot of words have been spoken and a lot of words have been written on the subject, and some of them have not always been as well informed as they might have been. It is important therefore that the whole approach to the preservation of the environment and the promotion of clean air should be viewed with common sense and with the avoidance of anything bordering on mass hysteria.

In the international field, the 2nd International Clean Air Congress which was held at the Sheraton Park Hotel, Washington from the 6th to 11th December 1970 was a landmark. The Congress was attended by some 2,500 delegates from 37 nations; over a period of 4 days, 256 papers from some 560 authors were presented and discussed at as many as 6 simultaneous sessions, almost all of which were well attended by attentive audiences. This serves to demonstrate the explosive growth of world wide interest in problems of atmospheric pollution. The Congress was on a considerable scale and was of high scientific quality. It had the declared intention to continue discussion on an international basis at the United Nations meeting on the environment in Stockholm in 1972 and the 3rd International Clean Air Congress which will be held in Germany in the Summer of 1973.

Great Britain contributed 12 papers with at least 1 in every section, and there is no doubt that these papers created a great deal of interest. It became apparent that America and the rest of the world have recognised, perhaps better than we have ourselves, that Great Britain has made a real and successful effort to combat air pollution; and other countries were very keen and anxious to learn how we have done this.

At home, February 1971 saw the publication of the first report of the Royal Commission on Environmental Pollution. The report serves to put the whole problem of pollution and its control into perspective. It recognises that there are economic factors which have to be considered as well as the fact that some of our resources are limited. The Royal Commission welcomes the success of the clean air policy in this country which "is encouraging but more needs to be done to apply this policy throughout the country and to inquire into the effects of pollutants from road vehicles. There are possible effects of atmospheric pollution on global weather and climate." These global effects are dealt with at some length, and although the members of the Royal Commission see no cause for alarm, they recommend "the extension of international monitoring of the atmosphere and the maintenance and extension of fundamental research on an international basis."

Another landmark, and indeed a great step forward, was the setting up towards the end of 1970 of the Department of the Environment under Mr. Peter Walker as Secretary of State. Mr. Walker has laid down the four priority objectives for his new Department. They are a reform of housing finance, local government, planning and a drive to make the polluter pay for pollution. Subjects as diverse as road planning, local government, housing, building and construction—and conservation—have come together under an integrated team. These subjects are under central direction "as part of an overall pattern. A pattern which affects all our lives—and those of the generations that follow." On pollution, Mr. Walker said "I am firmly of the view that those who pollute must pay for it. Whether it be at sea, in the air, on the land—or shall we say, in the eye. The fact that we are today so much aware of the problems of conservation does give us a much better chance of beating the problems of the 20th century 'wastemakers'."

The Department of the Environment has already published the Government White Paper on local government reform, which at the time of writing, is being widely and deeply discussed throughout the country. One of the recommendations that this White Paper makes is that the responsibility of clean air should pass to the top tier authorities. Not all who read this will be in agreement with such a policy and there will be a number of protests from authorities who consider that the responsibility for furthering a clean air policy should remain with those who have been already carrying it out successfully for some time. What the final outcome will be remains to be seen, but the very interest which this has engendered serves to show how keenly very many people in this country do now feel about clean air. This is the important point; not who is responsible for the policy.

1970 will, on the other hand, be remembered in many quarters as the year in which there was a severe shortage of solid smokeless fuel and which caused the suspension of more than 550 smoke control orders. That this should have happened at all was in itself deplorable. That it should have happened in 1970, European Conservation Year, was, to say the least, doubly unfortunate. However, enough has been said about this. More important, perhaps, than the actual suspensions, which were for a limited time only, was the holdup in the progress of smoke control areas. Nevertheless smoke control did go ahead and figures show that 93 new smoke control areas did become effective in the period under review. This is a big drop on last year which continues the downward curve. However, the manufacturers of solid smokeless fuel now assure us that the supply position is back to normal, that suspended orders can be rescinded and the establishment of new smoke control areas can get under way with real impetus once more. It is known that many local authorities did indeed proceed with their planning during this twilight period and it is confidently expected that the next 12 months will see an increase in the number of new areas becoming operative.

All in all, the period 1970 to 71 has been one of preparation and promise. We look forward to the fruits of this in the months and years that lie ahead.

AIR POLLUTION RESEARCH PROGRAMME IN THE UNITED KINGDOM

The following information is published by courtesy of the Interdepartmental Committee on Air Pollution Research, and is largely based on information supplied by the research organisations involved.

The table lists all research known to be in progress in 1970 and either partly or wholly funded by the government but it does not claim to be either exhaustive or fully up-to-date. It also includes some industrial organisations known to be concerned with air pollution research, but no attempt has been made to make it complete in this respect.

The programmes are arranged by subject in five parts, viz:

Part 1: Abatement of Emissions of Pollutants
Part 2: Dispersion and Distribution of Pollutants
Part 3: Effects on Health
Part 4: Effects on Animal Life, Vegetation and Materials
Part 5: Measurement Methods

Problem	*Investigation*	*Organisation*	*Officer Responsible*
Part 1. Abatement of Emissions of Pollutants			
1.1 Sulphur compounds	(a) Removal from natural gas and residual fuel oils	University of Strathclyde, Dept. of Pure and Applied Chemistry, Glasgow, C.1.	—
	(b) Development of adsorbents for removal of SO_2 from flue gases	C.E.G.B.	—
	(c) Removal from gases in fluid bed combustion systems:		—
	(i)	B.C.U.R.A.	—
	(ii) retention of sulphur by addition of limestone, and suppression of nitrogen oxides	N.C.B., Coal Research Establishment	—
1.2 Oxides of nitrogen (see also 1.12)	(a) Formation in combustion systems (project completed for Ph.D. thesis)	University of Sheffield, Dept. of Fuel Technology and Chemical Engineering, Newcastle Street, Sheffield, 1, Yorks.	Dr. A. B. Hedley Dr. E. Rothwell
1.3 Grit and dust	(a) Improvement in electrostatic precipitation	C.E.G.B.	—
	(b) Reduction of pollution due to ash disposal	do.	—
	(c) Identification of grit and dust	W.S.L.	—
	(d) Measurement of emission from chimneys	do.	—
	(e) Dust in foundries: variation in concentration and characteristics; sampling methods; exhaust systems; improvement in ventilation standards; abatement of brown fumes	Steel Castings Research and Trade Association, East Bank Road, Sheffield, 2, Yorks.	Dr. H. T. Hall (Director)
	(f) Iron and steel works: development of fumeless steel making techniques (N.B. R. & D. Depts of B.S.C. operating groups also carry out investigations, e.g. on cleaning installation design and efficiency, surveys of fume and dust deposition round works)	British Iron and Steel Research Association/Inter-Group Laboratories of British Steel Corporation, P.O. Box 403, 33 Grosvenor Place, London, S.W.1.	G. E. Speight
	(g) Dust in coal mining, composition and distribution	N.C.B., Pneumoconiosis Field Research	—
	(h) Dust control	N.C.B., Mining Research and Development Establishment	—
	(j) Development of mechanised ash removal systems	B.C.U.R.A.	—
1.4 Air pollution from combustion	(a)	London University: University College, Dept. of Mechanical Engineering, Gower Street, London, W.C.1.	Professor H. Billett

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Provision of field team	B.C.U.R.A.	
	(c) Formation of aromatic polycyclic hydrocarbons involving pyrolysis of polymeric materials formed in combustion; formation of carcinogenic or toxic materials in industrial processes	London University: Imperial College of Science and Technology, Dept. of Civil Engineering, Public Health Engineering Section, Prince Consort Road, London, S.W.7.	Dr. R. Perry
1.5 Oil-fired appliances	(a) Emission from appliances ranging from space heaters to power station boilers, steel and chemical manufacturing plant	Esso Petroleum Co. Ltd. Esso Research Centre, Abingdon, Berks.	The Director of Research
1.6 Industrial chimneys	(a) Emissions: measurement (and advice on control)	B.C.U.R.A.	—
1.7 Liquid and gaseous petroleum fuel-fired combustion equipment	(a) Study of combustion in continuous domestic and industrial combustion appliances; effect of fuel, design and operating conditions on emissions	Shell Research Ltd., Central Laboratories, Whitehall Lane, Egham, Surrey	The Director
	(b) Development of equipment for determination in field work of, e.g. exhaust carbon concentration, SO_2/SO_3 level, unburnt hydrocarbons in domestic exhaust gases	do.	—
1.8 Brickworks, etc.	(a) Identification of stages of cycle at which pollutants (fluorine, oxides of sulphur, obnoxious smell) are emitted; identification of compounds and mechanisms responsible for smell; removal of odours and noxious components from waste gas (identification of stages completed)	W.S.L.	—
	(b) Reduction of smoke during firing of blue engineering bricks, roofing tiles and floor quarries, of fume during salting period in firing salt-glazed pipes, of acid soot and fumes especially from oil-fired kilns and/or when firing sulphur-bearing clays in the structural ceramic and refractories industry and of fluorine from pottery kilns; overcoming health hazard from dust in clay industries	British Ceramic Research Association, Queens Road, Penkhull, Stoke-on-Trent, Staffs.	Dr. N. F. Astbury C.B.E. (Director)
	(c) Reduction of pollution arising from salt glazing and blue brick manufacture	Gas Council, 4/5 Grosvenor Place, London, S.W.1, and North East, East Midland and West Midland Gas Boards	T. E. D. Mason (Secretary, Gas Council)
1.9 Welding and flame cutting	(a) Study of toxic thermal degradation products	University of Newcastle upon Tyne, Dept. of Industrial Health, Newcastle upon Tyne, 1, Northumberland	Professor R. C. Browne
1.10 Coking plant	(a) Reduction of smoke emissions during oven charging; measurement and abatement of pollutants from coking plant	British Coke Research Association, Coke Research Centre, Chesterfield, Derbyshire	Dr. G. W. Lee (Director)
1.11 Industrial plant, especially copper and aluminium work	(a) Measurement of emissions to atmosphere; fume collection	British Non-ferrous Metals Research Association, Euston Street, London, N.W.1	Dr. A. J. Kennedy (Director)
1.12 Motor vehicles	(a) Diesel smoke: (i) measurement and reduction	W.S.L., M.I.R.A.	— —
	(ii) elimination	London University: Queen Mary College, Dept. of Mechanical Engineering, Mile End Road, London, E.1.	Professor M. W. Thring

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Control of diesel exhaust gases	British Internal Combustion Engine Research Institute Ltd., 111–112 Buckingham Avenue, Slough, Bucks.	The Director
	(c) Effect of petrol injection on exhaust pollution	Plymouth College of Technology, Dept. of Mechanical Engineering, Plymouth, Devon	E. C. Thomasson F. J. Woodgate
	(d) Exhaust emissions from petrol engines: effect of mixture preparation and combustion chambers on single cylinder engine; control of nitrogen oxides by M.I.R.A. exhaust recirculation; assessment of different measuring procedures	M.I.R.A.	—
	(e) Catalytic devices for control of car engine exhausts	Laporte Industries Ltd., General Chemicals Division (incorporating Peter Spence & Sons Ltd., Widnes, Lancs.)	The Manager of Research
	(f) Effect of internal combustion engine fuels and operating conditions on exhaust gas characteristics; cleaning devices	(1) Esso Petroleum Co. Ltd., Esso Research Centre, Abingdon, Berks. (2) Shell Research Ltd., Thornton Research Centre, P.O. Box 1, Chester	The Director of Research The Development Director
	(g) Emissions from vehicles; examination	British Petroleum Co., Petroleum Division, Research Centre, Chertsey Road, Sunbury-on-Thames, Middlesex	The Manager
	(h) Reduction of oxides of nitrogen by reaction with carbon monoxide over a catalyst	W.S.L.	—
1.13 Aircraft (see also 5(m))	(a) Production and consumption of pollutants from rich hydrocarbon/air flames, at high pressures, with particular reference to aircraft gas turbine conditions	National Gas Turbine Establishment, Pyestock, Farnborough, Hants.	D. I. Dawton
1.14 Domestic smoke	(a) Production of solid smokeless fuels: production scale work on carbonisation of small coal in a fluidised bed followed by briquetting of char without a binder, and on briquetting of coal with pitch, followed by a mild heat treatment	(1) N.C.B., Coal Research Establishment (2) B.C.U.R.A.	— —
	(b) Development of domestic appliances (room heaters and domestic central heating boilers) for burning small graded bituminous coal smokelessly	N.C.B., Coal Research Establishment	—
	(c) Measurement of smoke emission from solid fuel-fired appliances and from manufactured solid fuels	(1) N.C.B., Coal Research Establishment (2) B.C.U.R.A.	— —
1.15 Pollution control	(a) Technical control and costs	Pollution Research Unit, University of Manchester, Mathematics Building, Oxford Road, Manchester MI3 9PL (with grant S.R.C. and S.S.R.C.)	Dr. N. Lee
1.16 Asbestos	(a) Development fibre re-enforced composite materials for building not containing asbestos	Dept. of the Environment, Buildings Research Station, Garston, Watford WC2 7JR	Director

Part 2. Dispersion and Distribution of pollutants

Problem	*Investigation*	*Organisation*	*Officer Responsible*
2.1 Study of dispersion of chimney gases in order to minimise pollution by correct design and siting of chimneys	(a) High isolated chimneys: surveys round power stations	C.E.G.B.	—
	(b) High chimneys in built-up areas: wind tunnel and full scale studies	C.E.G.B. and Bristol University under contract to C.E.G.B.	—
	(c) Chimney design in relation to nearby buildings: comparison of wind tunnel and full scale tests	W.S.L.	—
	(d) Ships' funnels and industrial chimneys; wind tunnel tests	National Physical Laboratory, Aerodynamics Division, Teddington, Middlesex	Dr. R. C. Pankhurst (Superintendent)
	(e) Contribution of multi-industrial boilers (including refineries) to ground level pollution; computer prediction of relationships between chimney heights, meteorological conditions and g.l.c. of SO_2	Esso Petroleum Co. Ltd., Esso Research Centre, Abingdon, Berks.	The Director of Research
	(f) Liquid model experiments on instantaneous or continued sources under various conditions of atmospheric stratification	Loughborough, University of Technology, Dept. of Electrical Engineering, Loughborough, Leics.	Dr. J. M. Richards
	(g) Studies involving release of tracer from or near the ground, and sampling resulting distribution with collectors on the ground or on balloon cables (completed)	W.S.L.	—
	(h) Study of discharge characteristics of low-level flue terminals	Gas Council, 4/5 Grosvenor Place, London, S.W.1	T. E. D. Mason (Secretary)
	(j) Wind tunnel tests with variation of wind and temperature profiles	Brighton College of Technology, Dept. of Applied Physics, Brighton, Sussex	P. Bradshaw
	(k) Use of Vortex rings to obtain very large rise for pollution, and allow use of low chimneys	British Hydromechanics Research Association, Cranfield, Beds. (under contract to N.R.D.C.)	The Director
2.2 Studies of dispersion and of meteorological factors in the upper air over town and country	(a) Studies of diffusion of particulate matter using lidar	W.S.L.	—
	(b) Study of atmospheric turbulence and convection in first few thousand feet above ground, using instruments on towers or on tethered balloons; turbulence up to 4,000 ft. using radiosondes, free or on tethered balloons	Met. Office	—
2.3 Studies of dispersion and of the influence of meteorological factors	(a) Estimation of concentration of pollutants from specified source under wide range of weather conditions	Met. Office	—
2.4 Studies of dispersion on global scale	(a) Monitoring of radioactive debris from nuclear explosions	A.E.R.E.	—
	(b) Application of radioactive techniques to, e.g. diffusion in stratosphere	A.E.R.E.	—
	(c) Study of theoretical dispersal of material in free atmosphere; application of study of world-wide atmospheric circulation	Met. Office	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
2.5 Studies of drift on continental or smaller scale	(a) Drift and decay of SO_2 near ground level and up to several thousand feet up	W.S.L. (possible future programme involving other organisations also under consideration)	—
	(b) Measurement of SO_2 over the North Sea	British Petroleum Co.	—
2.6 Distribution of pollutants throughout Great Britain, especially in relation to application of the Clean Air Act	(a) The National Survey of Smoke and Sulphur Dioxide	W.S.L., in co-operation with Local Authorities, the C.E.G.B., and other organisations	—
2.7 Distribution of pollution in urban areas in relation to meteorological and geographical factors and to the needs of medical investigators, town planners, etc.	(a) Sheffield:	Sheffield University, Dept. of Geography, Western Bank, Sheffield 10, and:	Professor Alice Garnett
	(i) (Contract ended June 1969; data analysis still continuing)	(i) W.S.L.	—
	(ii)	(ii) Centre for Environmental Studies	—
	(iii) Study of incidence of pulses of high SO_2 concentrations, emission in Don Basin, and correlation with absence from work due to respiratory infection	(iii) Gas Council	—
	(b) Edinburgh (with grant from W.S.L.) (Contract ended; data being analysed)	Edinburgh University, Dept. of Geography, High School Yards, Edinburgh, 1	Dr. A. J. Crosbie
	(c) London:		
	(i) using National Survey and additional air pollution data;	W.S.L.	
	(ii) with particular reference to temperature and application of trend surface analysis;	London University: University College, Dept. of Geography, Gower Street, London, W.C.1	Professor T. J. Chandler
	(iii) continuous survey at 27 sites; study of pollution in relation to high buildings; traffic pollution in tunnels; air-borne radioactive pollution	Greater London Council, Scientific Branch, County Hall, London, S.E.1	The Chief Scientific Adviser
	(d) Reading, with particular reference to meteorological factors (written up as Ph.D. thesis)	University of Reading, Dept. of Geography, Reading, Berks.	M. Parry
	(e) Brighton, with particular reference to temperature	London University: University College, Dept. of Geography, Gower Street, London, W.C.1	Professor T. J. Chandler
	(f) Special surveys to give basic information for planning and for evaluation of town surveys	W.S.L.	—
	(g) Pollution in city streets:		
	(i) and other environmental conditions in streets	London University: Imperial College of Science and Technology, Dept. of Civil Engineering (Transport), Prince Consort Road, London, S.W.7.	D. H. Crompton
	(ii) carbon monoxide (in six towns)	W.S.L.	—
	(iii) CO inside cars in relation to vehicle's own exhaust system	W.S.L.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(h) Diffusion and removal of pollution: (i) natural removal indoors; (ii) pulses of concentration and atmospheric turbulence	London University: Imperial College of Science and Technology, Dept. of Chemical Engineering, Prince Consort Road, London, S.W.7	Dr. M. J. G. Wilson
2.8 Air pollution in relation to climate etc.	(a) Teesside and County Durham	University of Durham, Dept. of Geography, Science Laboratories, South Road, Durham City, Co. Durham	Professor W. B. Fisher
	(b) Investigation of the geographical distribution of mist on Teesside and the correlation between visibility, chemical composition of the atmospheric aerosol and other meteorological factors; (ii) measurement of ammonia and SO_2 levels on Teesside to study the kinetics of their conversion to ammonium sulphate, a major contribution to the mist; identification of the meteorological and other factors which assist the conversion; (iii) comparison measurements of ammonia, SO_2, ammonium sulphate and other particulates at other sites in the country; (iv) laboratory investigations of the kinetics of both the homogeneous and heterogeneous formation of ammonium sulphate from ammonia and SO_2	A.E.R.E.	—
	(c) Measurement of radiative properties of cloud, fog and haze	N.E.R.C., and Oxford University, Dept. of Atmospheric Physics	Dr. J. T. Houghton
	(d) Effect of air pollution on income of short wave radiation at the surface and on radiation balance	University of Nottingham, School of Agriculture, Dept. of Physiology and Environmental Studies	Professor J. L. Monteith
	(e) Stability of aerosols and fog formation in presence of pollutants such as oxides of sulphur and of nitrogen	University of Sheffield, Dept. of Fuel Technology, Newcastle Street, Sheffield, 1, Yorks. (with grant from S.R.C.)	Professor J. M. Beer
2.9 Pollutants in remote areas	(a) Sulphur, chlorine, sodium, potassium, calcium, magnesium, ammonia, in air and in rain; NO_3 and H_2CO_3 in rain; measurements at three sites	Met. Office (analysis by the Laboratory of the Government Chemist)	—
	(b) Sulphur dioxide and smoke in air	W.S.L.	—
	(c) Aerobiology in relation to forest disease development (dispersal of fungus spores)	N.E.R.C., and Oxford University, Forestry Dept.	Dr. T. W. Tinsley and R. G. Pawsey
	(d) Effects of forest stands on drifting polluted air	Portsmouth College of Technology, Dept. of Biological Sciences, Hampshire Terrace, Portsmouth, Hants.	F. N. Haynes
2.10 Life-history of pollutants in the atmosphere	(a) Laboratory studies of SO_2 oxidation to sulphuric acid and ammonium sulphate; uptake of SO_2 on surfaces; life-cycle of SO_2 in the atmosphere (see also 2.8b)	A.E.R.E.	—
2.11 Bactericidal properties of pollutants	(a) Studies of bactericidal properties of pollutants in urban areas with special reference to recognition of the presence of olefin-ozone reaction products	Ministry of Defence, Biological and Chemical Defence, St. Christopher House, Southwark Street, London, S.E.1	G. D. Heath (Director)

Problem	*Investigation*	*Organisation*	*Officer Responsible*
2.12 The future of air pollution levels	(a) Forecasting pollution (including air pollution)	The Pollution Research Unit, with grant S.R.C. and S.S.R.C. (for address see 1.15)	Dr. N. Lee
Part 3. **Effects on Health** Medical research to indict as far as possible specific pollutants responsible for ill effects on health and to suggest maximum levels of tolerance			
3.1 Specific pollutants	(a) Carcinogens: polycyclic hydrocarbons, sources, stability, health hazards, etc.	M.R.C., Air Pollution Unit	—
	(b) Smoke extracts and tobacco tar: carcinogenicity. Response to inhaled smoke from different types of tobacco, inhaled gas (chlorine, SO_2) and to combinations of such exposures	London University: Institute of Cancer Research, Chester Beatty Institute, Fulham Road, London, S.W.3	The Director Chester Beatty Institute
	(c) Acid particles: including study of length of life of SO_3 vapour in air before conversion to acid	M.R.C., Air Pollution Unit	—
	(d) Carbon monoxide: effect on performance and vigilance; measurement of carboxyhaemoglobin	do.	—
	(e) Asbestos:		
	(i) study of structure and behaviour in biological systems using induced radioactivity; analysis of reference samples using neutron activation;	A.E.R.E.	—
	(ii) identification; chemical and physical properties in relation to carcinogenicity; contaminating substances and biological significance;	M.R.C., Air Pollution Unit	—
	(iii) asbestos and mesothelioma in Scotland;	M.R.C. and Dundee University, Dept. of Social and Occupational Medicine, Dundee, Scotland	Professor A. Mair
	(iv) physiological effects	M.R.C., Pneumoconiosis Research Unit	—
	(f) Irritants: effect on bronchial mucosa	M.R.C., Air Pollution Unit	—
3.2 Occupational health (a) (see also 1.8(b)	(a) Industrial dust disease: role of air pollution in relation to regional differences in prevalance of	do.	—
	(b) Steelworkers: chronic respiratory disease and particulate and chemical pollution levels at home and work	University of Wales, Welsh National School of Medicine, Dept. of Social and Occupational Medicine, The Parade, Cardiff, Wales	Professor C. R. Lowe
	(c) Physiological effects of industrial dusts, coal, hard metal dusts, beryllium	M.R.C., Pneumoconiosis Research Unit	—
	(d) Pneumoconiosis and other pulmonary diseases in coal mining:	N.C.B., Institute of Occupational Medicine	—
	(i) Study of relationship between respirable dust in the mining environment and the development of pneumoconiosis, in order to establish standards of dust control		
	(ii)	N.C.B., Pneumoconiosis Field Research	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(e) Bronchitis: study of attack rate in relation to differing quality and composition of respirable dust in the mining environment	N.C.B., Institute of Occupational Medicine	—
	(f) Metabolism of chlorinated hydrocarbons using chlorine-38 labelled materials	A.E.R.E.	—
3.3 Studies of lung function, etc.	(a) In healthy and bronchitic subjects; effects of pollutants; lung as pneumatic system	M.R.C., Air Pollution Unit	—
	(b) Lung florae: effect of pollutants on	do.	—
	(c) Bronchitis: effect of smoking on	M.R.C., Pneumoconiosis Research Unit	—
	(d) Effect of particle size and flow rate on deposition of particulate material in the human nose; clearance of deposited particles from usual passages	A.E.R.E.	—
	(e) Dust deposit in lungs in health and chronic respiratory disease	N.C.B., Pneumoconiosis Field Research	—
3.4 Epidemiology	(a) Trends in pollution and health in London	M.R.C., Air Pollution Unit	—
	(b) Air pollution and rates of consultation for respiratory disease, in relation to age, sex and smoking	Royal College of General Practitioners, Air Pollution Study Group, 14 Princes Gate, London, S.W.7	— Dr. Stuart Carne
	(c) Chronic respiratory diseases in relation to pollution and smoking in the U.K.; international studies in Britain, U.S. and Norway with particular reference to migrants from Britain; upper and lower respiratory tract disorders in town and country children	London University: London School of Hygiene and Tropical Medicine, Dept. of Medical Statistics and Epidemiology, Keppel Street, London, W.C.1	Professor D. D. Reid
	(d) Respiratory disease and function in young families in Harrow, and in schoolchildren in Kent	London University: St. Thomas's Hospital Medical School, Dept. of Clinical Epidemiology and Social Medicine, London, S.E.1	Professor W. W. Holland J. R. T. Colley
	(e) Respiratory study of Sheffield schoolchildren in relation to air pollution	Sheffield University, Dept. of Preventive Medicine and Public Health, Western Bank, Sheffield, 10, Yorks.	Dr. J. G. Lunn
	(f) Lung cancer mortality in relation to urban factors	M.R.C., Air Pollution Unit	—
	(g) Studies of effects of air pollution	Dept. of Health and Social Security, Room A413, Alexander Fleming House, Elephant and Castle, London, S.E.1	Dr. A. E. Martin
3.5 Public Health	(a) Public Health administration, with special reference to prevention of air pollution and effect of housing on health	Liverpool University, Dept. of Public Health, Liverpool, Lancs.	Professor A. B. Semple
3.6 Economic aspects	(a) Survey of literature on economic aspects of damage to health, material, etc., due to pollution	Pollution Research Unit, with grant S.R.C. and S.S.R.C. (address see 1.15)	Dr. N. Lee
Part 4. Effects on Animal Life, Vegetation and Materials (*see also* 3.6)			
4.1 Animal life	(a) Fluorosis in farm animals	Ministry of Agriculture, Fisheries and Food, Central Veterinary Laboratory, New Haw, Weybridge, Surrey	The Director

Problem	*Investigation*	*Organisation*	*Officer Responsible*
4.2 Vegetation (see also 2.9c and 2.9d)	(a) Lichens and bryophytes: (i) construction of computer maps of pollution using pollution-sensitive species;	London University: King's College, Dept. of Geography, Strand, London, W.C.2	Dr. F. Rose Dr. P. D. Coker
	(ii) use as indicators of urban and industrial pollution (project completed);	University of Newcastle upon Tyne, Dept. of Botany, Newcastle upon Tyne 1, Northumberland	Dr. O. L. Gilbert
	(iii) effect of fluorides;	University of Sheffield, Dept. of Landscape Architecture	Dr. O. L. Gilbert
	(iv) effect of air pollution near steel works on lichens and other plant groups	Bromley College of Technology, Dept. of Applied Biology	Dr. F. B. Pyatt
	(v) effect of SO_2 on metabolism of lichens	Oxford University, Dept. of Agricultural Sciences	D. J. Hill
	(vi) effect of air pollution on epiphytic bryophytes	London University: Queen Mary College, Mile End Road, London, E.1	P. J. Wanstall
	(vii) effects of air pollution on epiphytic bryophytes and bark of oak trees	London University: University College and Oxford University, Genetics Laboratory, Dept. of Zoology	Dr. J. G. Duckett Dr. E. R. Creed D. R. Lees
	(b) Uptake of SO_2 by vegetation (work completed)	A.E.R.E.	—
	(c) Response of stomata to air pollution	N.E.R.C. and University of Lancaster, Biology Dept., Lancaster, Lancs.	Dr. R. A. Mansfield
	(d) Effect of air pollution on soils and vegetation	University of Strathclyde, Dept. of Geography, Glasgow, C.1	R. Moss
	(e) Effect of lead pollution from the atmosphere on soils and vegetation	Macaulay Institute, Aberdeen	Dr. R. L. Mitchell
	(f) Growth of trees in Pennines in relation to air pollution	Forestry Commission, Research Div. Alice Holt Lodge, Wrecclesham, Farnham, Surrey	Dr. D. H. Phillips
	(g) Growth of trees around new aluminium smelter and oil refinery	Forestry Commission	—
	(h) Effect of nearby major source of pollution on deciduous woodland	University of Wales: Cardiff Institute of Science Technology, Dept. of Applied Biology, Cathays Park, Cardiff, Wales	Professor R. W. Edwards
	(j) Husbandry practices to alleviate effects of air pollution; field studies	Ministry of Agriculture, Fisheries and Food, National Agricultural Advisory Services, Great House Experimental Farm, c/o Great Westminster House, Horseferry Road, London, S.W.1	The Director, Great House Experimental Farm
	(k) Effect of air pollution on plant growth in glasshouses	Ministry of Agriculture, Fisheries and Food, National Agricultural Advisory Services, Lee Valley Experimental Horticulture Station, Ware Road, Hoddesdon, Herts.	The Director

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(l) Mechanism of entry of fluorine into plants; levels in air and rate of deposition under varying meteorological conditions	A.E.R.E.	—
	(m) Effects of SO_2 on fungi	National Institute of Agricultural Botany	P. J. W. Saunders
	(n) Effects of hydrocarbons (mainly liquid but also gaseous) on plants	British Petroleum Co., Petroleum Division, Research Centre, Chertsey Road, Sunbury-on-Thames, Middlesex	The Manager
4.3 Materials	(a) Uptake of SO_2 by building materials (see also 2.7(h)(i))	A.E.R.E.	—
	(b) Effect of air pollution as a factor in the durability of building materials (stone, concrete, surface coatings, plastics, metals, fired clay products)	Ministry of Public Buildings and Works, Building Research Station, Garston, Watford, Herts.	The Director
	(c) Effect of air pollution on high voltage (25 kV) insulators	British Railways Board, Electrical Research Division, Blandford House, Melbury Terrace, London, N.W.1	The Director
	(d) Effect of climate and air pollution on corrosion of steel	British Iron and Steel Research Association/Inter-Group Laboratories of British Steel Corp., P.O. Box 403, 33 Grosvenor Place, London, S.W.1	G. E. Speight
	(e) Effect of weather and air pollution on life of paint films; effect of light on paint degradation	1. Research Association of British Paint, Colour and Varnish Manufacturers, Paint Research Station, Waldegrave Road, Teddington, Middlesex 2. C.E.G.B.	The Director
	(f) Effect of air pollution, weather, light on degradation of titanium dioxide pigments in various media (concentrated mainly on weather and light)	British Titan Products Co. Ltd., Carlton Weathering Test Station, Yarm Back Lane, Hartburn, Stockton-on-Tees, Co. Durham	The Superintendent
	(g) Vertical distribution of air pollution at the Post Office Towers in London and Birmingham (in connection with effect on P.O. equipment)	Post Office Purchasing and Supply Dept., Materials Section, (i) Studd Street, London, N.1 (ii) Fordrough Lane, Birmingham, 9, Warwicks. (In collaboration with W.S.L.)	Dr. J. C. Harrison (London) R. J. Feasey (Birmingham)
Part 5: Measurement Methods (*See also specific programmes in Parts 1 to 4*)	(a) Studies on chemical and physical nature of pollutants; reactions between pollutants; methods for their determination; improvement of comparability of methods in different places; use of electron microscopy and diffraction techniques for identification of particulates	M.R.C., Air Pollution Unit	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) (i) Improvement of existing methods of measuring the concentration and history of pollutants in each other's presence	Ministry of Defence, Biological and Chemical Defence, St. Christopher House, Southwark Street, London, S.E.1	G. D. Heath (Director)
	(ii) method for using micro-organisms to recognise the degree of activity of biocidal pollutants not detectable by chemical means	do.	—
	(c) SO_2 recorders; directional samplers; automatic data logging and telemetering; international standardisation of methods	W.S.L.	—
	(d) Development of simple, rapid methods for determination of toxic substances in industrial atmospheres	Laboratory of the Government Chemist, Cornwall House, Stamford Street, London, S.E.1	Dr. D. T. Lewis (Government Chemist)
	(e) Correlation between methods of SO_2 determination	University of Salford, Dept. of Civil Engineering, Salford, 5, Lancs.	G. Rhodes F. L. Thomas
	(f) Electron microscopy and diffraction techniques for identification of air pollution particles; flow behaviour of airborne particles	University of Wales: University College of South Wales and Monmouthshire, Dept. of Mineral Exploitation, Cardiff, Wales	Professor J. Platt
	(g) Examination of smoke filter papers using spectrographic and atomic absorption methods; isolation of hydrocarbons using gas and thin layer chromatography	Blackburn College of Technology and Design, Dept. of Pure and Applied Science, Blackburn, Lancs.	S. Hargreaves
	(h) Dust analysis	M.R.C., Pneumoconiosis Research Unit	—
	(j) Dust sampling and analysis; mainly in relation to dust produced by working in coal and rock in mines and the pneumoconiosis problems; development of sampling and recording instruments; use of electron microscopy, X-ray diffraction and infra-red spectrophoretic methods in dust analysis; oxygen meter	Safety in Mines Research Establishment, Central Laboratories, Red Hill, Broad Lane, Sheffield 3, Yorks.	The Director
	(k) (i) Development of laser-operated aerosol spectrometer;	A.E.R.E.	—
	(ii) automatic continuous measurement of visibility by light scattering; automatic hourly filter tape equipment for collection of particulate matter, SO_2, ammonia and other pollutants;	do.	
	(iii) data-logging equipment for measurement of meteorological parameters in association with the previous equipment; electron microscopy and diffraction for examination of atmospheric aerosols	do.	
	(iv) atmospheric stability indicator, based on measurement of radon daughter products in the atmosphere	do.	

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(l) (i) Sulphurous odour pollutants: human perception, and rapid measurement of concentration in air;	London University, Imperial College of Science and Technology, Dept. of Chemical Engineering and Chemical Technology, Prince Consort Road, London, S.W.7	Dr. M. J. G. Wilson
	(ii) study of acid particles using metal film technique	do.	
	(m) Simple, rapid sampling and analysis of aero gas turbine combustion products, using current gas solid chromatographic techniques; discrimination between different types of petroleum fuel products	National Gas Turbine Establishment, Pyestock, Farnborough, Hants.	D. I. Dawton
	(n) Dust measurement; monitoring dust in flues and chimneys	C.E.G.B.	—
	(o) Analysis of aromatic polycyclic hydrocarbons in airborne particulates, soots and oils using gas chromatography and mass spectrometry; analysis of lead tetramethyl and tetraethyl and of trace metal pollutants	London University, Imperial College of Science and Technology, Civil Engineering Dept., Public Health Engineering Section, Prince Consort Road, London, S.W.7	—

Organisation	*Full name and address*	*Officer responsible*
A.E.R.E.	Atomic Energy Research Establishment, Health Physics and Medical Division, Hanwell, Didcot, Berks.	N. G. Stewart
C.E.G.B.	Central Electricity Generating Board, Research and Development Dept., Grindall House, 25 Newgate Street, London, E.C.1	F. F. Ross (Co-ordinator)
Met. Office	Meteorological Office, London Road, Bracknell, Berks.	Dr. B. J. Mason (Director General)
M.I.R.A.	Motor Industry Research Association, Lindley, near Nuneaton, Warwicks.	—
M.R.C.	Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical School, Charterhouse Square, London, E.C.1	Professor P. J. Lawther
	Pneumoconiosis Research Unit, Llandough Hospital, Penarth, Glamorgan, Wales	The Director
N.C.B.	National Coal Board, (Head Office) Hobart House, Grosvenor Place, London, S.W.1	
	Coal Research Establishment, Stoke Orchard, Cheltenham, Glos.	Dr. J. Gibson (Director)
N.E.R.C.	Natural Environment Research Council, 27/33 Charing Cross Road, London, W.C.2	
W.S.L.	Warren Spring Laboratory, Dept. of Trade and Industry, P.O. Box 20, Gunnels Wood Road, Stevenage, Herts. SG1 2BX	

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Following the making of a smoke control order or house improvement scheme, the residents in your area will need to know how the Clean Air Act and smoke control regulations affect them. They will also want help and information on Solid Fuel appliances, how to operate them, what sort of fuel to use, and, of course, how much it is all likely to cost. This is where the comprehensive services offered free by the Solid Smokeless Fuels Federation can be of tremendous benefit. These aids include Exhibitions, Mobile Units, Displays and Literature, all designed to present the Clean Air story simply and clearly.

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Mobile Units

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A range of portable units giving information on all aspects of Clean Air, House Improvements, fuels and appliances.

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For further information on the advice and assistance that the S.S.F.F. can give to Local Authorities, please write to the address below.

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Since the mid 'fifties' a massive programme of investment in plant and distribution facilities has led to a ten-fold increase in turnover —today running at some £6 million a year, and increasing still.

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The Warren Spring Laboratory of the Department of Trade and Industry

Warren Spring Laboratory carries out research on the nature and extent of air pollution, and on its prevention and abatement, in order to provide technical information necessary for the administration of clean air legislation, for town planning and the location of industry, and for research into the effects of air pollution.

The National Survey of Air Pollution

Ten years ago the existing scheme of daily observations of smoke and sulphur dioxide, made by Local Authorities and others in co-operation with the Warren Spring Laboratory, was extended in such a way as to form a National Survey from which valid conclusions could be drawn on the incidence of air pollution in urban areas throughout the United Kingdom. There are now, 31 March, 1970, 485 Authorities making these observations at 1,197 sites, and of these sites, 164 are in the country to give background information, for comparison.

In addition, monthly measurements of grit- and dust-fall are made with the British Standard Deposit Gauge by 192 Authorities at 675 sites. Monthly measurements are also made of the rate of reaction of sulphur compounds in the atmosphere with a standard lead dioxide surface, by 99 Authorities at 389 sites.

The Laboratory gives help and advice on all aspects of this co-operative investigation. In particular, newcomers to the scheme are advised on the selection of suitable sites for their instruments.

All data submitted to the Laboratory are collated and published as Annual Tables. For smoke and sulphur dioxide, these Tables give, for each site and for each month in the year, the average concentration, the highly daily concentration and the number of days when the concentration exceeded certain limits. The seasonal and annual average figures are also given. For grit- and dust-fall, and for the lead dioxide observations, the data for each month and the seasonal and annual averages are given.

Abstracts of papers and other information on air pollution are also published monthly.

These Annual Tables and Abstracts are available on request to all concerned with problems of air pollutions.

In addition, a series of Reports on the Investigation of Atmospheric Pollution published by H.M. Stationery Office, gave analyses of these results and an account of research on the measurement and abatement of air pollution.

The last in this series, the 32nd Report, brought the position up to date to 1966, and gave, in addition, an account of the changes in the administrative arrangements.

A series of Reports on the state of air pollution in the United Kingdom, as shown by the National Survey, is now in course of preparation. Drafts for the standard statistical regions are now under discussion with the Standing Conference (see below) and the first two, on the South-East Region, and on London, should be ready for publication this year. A definitive paper on trends in pollution over the last 10 to 20 years has been prepared using the whole of the National Survey data. Part of this is now in the press, and the remainder will be available shortly. This will ultimately form part of a General Introduction to the Survey Reports.

Standing Conference of Co-operating Bodies

All local authorities and other organisations who make measurements of air pollution, either as part of the National Survey or purely for their own local purposes, and who submit the data regularly to Warren Spring Laboratory for publication, are entitled to send representatives to the Standing Conference of Co-operating Bodies. Other bodies may do so on payment of a subscription. This Conference meets twice yearly to discuss matters of interest connected with air pollution. At 31 March, 1970, 438 bodies had appointed representatives to the Conference.

Automatic Instruments

A system has been devised whereby a sulphur dioxide recorder in the Warren Spring London Laboratory at Islington is plugged into the Post Office telephone and, on dialling the Islington number from the Stevenage laboratory, the reading of the recorder appears on a dial at Stevenage. If pollution is abnormally high at Islington the recorder there automatically dials the Stevenage laboratory, where it rings an alarm bell. Effort is now concentrated on the automation of recording stations so that the data from continuous or other recorders can be fed directly into a computer.

Town Planning Studies

In the past few years it has become increasingly apparent that while it is quite impracticable to control the amounts of sulphur oxides in the air by limiting their emission (as is done for smoke under the Clean Air Act), it is, nevertheless, possible to make great improvements by taking full advantage of natural dispersion processes. This can be done by the proper design of chimneys in relation to buildings and the proper siting of the various types of residential district in relation to each other and to industrial installations. A great deal of effort is being devoted to obtaining sufficient knowledge of the distribution and spread of pollution in urban areas to enable town planners to do their work satisfactorily from an air pollution point of view.

While the National Survey provides information on the distribution of pollution in urban areas this is being supplemented by special investigations. For example, a survey is being undertaken as part of the programme of the Warren Spring Laboratory by the Department of Geography of the University of Edinburgh to examine the build-up and dispersion of pollution over the city. The effects of topography, weather conditions, and the relation of industry to housing are being examined.

The general problem of the ventilation of cities is being studied in London by observations at various heights on the Post Office Tower. Laser equipment has been purchased and is now coming into operation to study the dispersion of particulate matter over cities.

A great deal of advice on the siting and heights of chimneys is given both to local authorities and to industry. This often requires tests of a model in a wind-tunnel, particularly when dealing with a complicated building complex or with difficult topography. A suitable tunnel has now been built at Stevenage so that this type of test can be undertaken. The tunnel will also be used to obtain more basic information on dispersion from chimneys.

Abatement of Nuisance from Malodorous Emissions

Now that such good progress has been made towards the removal of smoke from towns, various other pollutants that previously tended to be overlooked in the generally smoky air, are becoming more and more apparent and are causing lively complaint. These are the malodorous emissions from various types of industry, from the offensive trades and, most widespread of all, from motor vehicle exhausts. Warren Spring Laboratory is examining these problems to see where there may be possibilities of solutions.

The Central Electricity Generating Board

The main sources of air pollution from the operations of the Generating Board are the products of combustion of coal and oil. These are considered under the headings of: separation of solids from gases; dust measurement; disposal of solids; dispersion of gases.

Separation of Solids from Gases

Both the older and more modern pulverised fuel plants rely on electrostatic precipitation as the final or only stage of separation of particulate matter from flue gases. A research programme has revealed unexpected deficiencies in gas distribution, in rapping and in power supplies in some older plants. As soon as this research can be applied to individual plants, the deficiencies are being made good. Poor gas distribution leads to reduced efficiency because the greater efficiency of dust removal in a starved channel does not fully compensate for the reduced efficiency in an overloaded one; when, by means of velocity measurements and model techniques, the gas flow has been analysed, baffles can be designed and inserted to smooth the flow. Rapping impulses by means of which the collected dust is removed from the precipitator electrodes, have been found by actual measurement with accelerometers to be much attenuated if transferred from one member, such as a holding frame, to another, such as the plate or wire itself. Research on optimum electrical sub-division of the precipitator has shown the need for maintaining maximum power supply to each section and the importance of correct electrode spacing to reduce flashover.

Statistical analysis of the results of efficiency tests has shown the relative contribution to efficiency of such factors as size of precipitator, degree of sub-division, specific collecting area, power input, and the characteristics of the ash and the coal. It is clear that too low a sulphur content impairs collecting efficiency by making the particles electrically non-conducting, but no simple practical means of increasing the effective sulphur content of the ash from low-sulphur coals has been developed for routine application. Since sulphur dioxide emitted from large power stations with tall stacks has been shown to make only a very small contribution to ground level concentrations, there is a case for reserving low-sulphur coal for use in small appliances in non-pulverised form.

Dust Measurement

An important part of a dust-arresting installation is some means of informing the operator of any failure to function correctly. The pollution by dust at ground level is caused in the main by particles in the range from 20μm upwards, and an instrument has therefore been developed known as the CERL Dust Monitor which gives a continuous record of the emission of these coarser particles which are not recorded by instruments used to measure the emission of smoke. The CERL Dust Monitor has recently been redesigned to give it the maximum reliability under power station conditions and the Mark II instrument is now commercially available from two firms and is being tried out in other industries including cement and iron works. The nuisance from excessive emissions is a function of total output over a period of time, and integrators for the sum of the readings of all instruments in a power station over an eight-hour shift period are under development.

With sufficient sensitivity, combined with accuracy in regard to the zero reading for clean gas, a smoke meter can give a useful indication of the dust content of flue gases. Such optical instruments are mainly influenced by the finest particles, but if the dust grading does not vary greatly at the outlet of a precipitator the readings of such instruments may correlate sufficiently well with dust-arresting performance to serve the purpose of an operational guide. An instrument which can be inserted from one side of a duct and removed for a manual check of the zero has been developed and is commercially available. An instrument which has no parts within the flue but measures light reflected from dust particles has been developed and is under trial. And a modification of the type of instrument which shines a light beam right across a duct is under development; this will give a frequent and automatic recording of the instrument zero.

Because it was thought that the standard deposit gauge had a limited application to modern dust problems, a new type of gauge has been developed for measuring dust in the field known as CERL Directional Dust Gauge. This has been used in routine measurements around a number of modern power stations and its directional characteristics are considered to be of considerable assistance in the interpretation of measured results. Its design is being modified to make it as cheap as possible to produce and is being incorporated in a British Standard Specification which will be published shortly.

Ash Disposal

Local air pollution can arise where dust which is handled or dumped is allowed to dry. Economical techniques of surface treatment are under investigation. There is a particular problem with cenospheres (floaters) on ash lagoons. These can dry on the surface layer and be picked up by the wind. A number of methods for dealing with this difficulty are now being investigated, from immobilising them *in situ* to harvesting them for industrial use.

Dispersion of Gases

Eight-day SO_2 samples are used routinely around power station sites for a number of years before and after commissioning of the stations. In addition a number of stations have been intensively instrumented using in each case about two dozen continuously recording SO_2 instruments and full meteorological instrumentation. The SO_2 recorders were developed about 10 years ago at CERL and have been successfully used in these surveys. The surveys have given excellent support to theoretical predictions and to the effectiveness of tall chimneys in controlling large-scale emissions of flue gas, as well as providing new knowledge on the particular influence of inversion layers above and below the chimney top. One important aspect of chimney height is now seen to lie in the proportion of inversions which are penetrated by the flue gases.

The Tilbury and West Burton investigations have been concluded. A further survey of this type is under way at Eggborough which is the first 2000MW power station employing a single chimney. This survey has 25 SO_2 recorders and meteorological measurements which for the first time give details of atmospheric conditions up to 1,250 feet from the surface of the Earth. The use of a laser to measure the height of a plume, even though it is invisible to the eye, has been developed for some years at the Tilbury survey. This will continue to be used at Eggborough and its use will also be developed to study the temperature profile of the atmosphere in the range immediately above 1,250 feet.

Other Potential Problems

Increase of ground level relative humidity downwind of cooling towers has been looked for, with negative results. On the relatively few occasions when the atmospheric relative humidity approaches 100 per cent a long plume is formed, and it has been reluctantly concluded that nothing can be done about the vagaries of nature.

The Atomic Energy Research Establishment

Objectives

The Harwell programme is concerned with the physical and chemical characteristics of pollutants, with pollutant life-cycles and reactions in the atmosphere and with the development of instruments. Particular attention is being paid to the problem of industrial mists but the programme also includes an investigation into the uptake of SO_2 by building materials and by vegetation.

Tees-side Survey

The object is to find out if there is more fog and mist on Tees-side than can be ascribed to geographical and meteorological factors alone and, if so, whether the cause is associated with any particular atmospheric pollutant.

The investigation in 1967 was based on the chemical analysis of samples of aerosols collected over 24-hour periods at five sites on Tees-side. The dominant pollutant among those considered as possible stabilisers of mist droplets was ammonium sulphate the concentration of which was shown to correlate rather well with the reciprocal of visual range as obtained from Tees-side airport. In the summer of 1968, sampling was extended to five other sites in England. Ammonium sulphate was found in fair quantities on all sites, the average concentration at Stockton-on-Tees being some 60 per cent higher than the lowest recorded (at Leconfield). Gaseous ammonia levels at Stockton were, however, relatively much higher. The data suggest that the conversion of ammonia to ammonium sulphate is a comparatively slow process but that, under certain conditions not yet understood, the conversion rate is sufficiently rapid for significant amounts to be formed in periods of one hour or less.

Development of Air Sampling Equipment

The scope of these first surveys was limited by the lack of suitable equipment. It became clear that in order to study effectively the dynamics of pollution situation, such as that on Tees-side, short-term sampling with local meteorological data collection was essential. It was decided therefore to develop suitable instruments and to incorporate them into an automatic sampling station capable of operating unattended for periods of up to one month. The following items of equipment have been developed.

(i) An automatic high flow-rate sampler for collecting hourly samples of aerosols on paper tape. Recently, an atmospheric stability indicator, based on measurement of the natural radon decay products, has been added.
(ii) An integrating nephelometer for measuring visibility by a light scattering technique.
(iii) A data logging system based on the Harwell 7000 series.
(iv) Impregnated paper tape samplers, specific for sulphur dioxide and ammonia.

Two of the automatic stations have operated successfully on Tees-side in the latter half of 1969 and two more are nearly ready. First results have been encouraging. When the samples from Stockton are grouped in narrow ranges of relative humidity, excellent correlation is found between the concentration of ammonium ion and the reciprocal of visual range determined by the nephelometer.

Physical Measurements on Fog and Haze Particles

A prototype automatic sampler has been developed for the special conditions of sampling required for electron microscopy of pollutant particles. By observation of shape, behaviour in the electron beam and by electron diffraction, it is possible to identify individual particles such as ammonium sulphate and to determine size distributions. Theoretical calculations of the light scattering expected at different relative humidities confirm that most of the Tees-side haze is due to ammonium sulphate.

Improved techniques for measuring the size distribution of water droplets in fog have revealed a much higher proportion of droplets of diameter less than two microns than has hitherto been observed. As a result, it is now possible to account for nearly all the light scattering coefficient of fog.

Life Cycle of SO_2 in the Atmosphere

Chemical and Photochemical Reactions

Conversion to ammonium sulphate is one of the processes by which sulphur dioxide is removed from the atmosphere. This mechanism and other reactions of sulphur dioxide are being studied in controlled atmospheres in the presence of water droplets, ammonia gas and various catalysts. Photochemical reactions are also being investigated.

Absorption of Sulphur Dioxide on Surfaces

Direct uptake on surfaces is believed to play an important part in the removal of sulphur dioxide from the atmosphere, and it may also be a factor in some corrosion problems. When studying processes of this type it is extremely important to use realistic concentrations of the pollutant to avoid the risk of swamping that effect which is the important one in practice. The use of labelled sulphur dioxide, $^{35}SO_2$, enables this criterion to be met. Experiments have been carried out on the uptake and metabolism of SO_2 on barley plants, on the surfaces and furnishings of rooms, on limestones and on various wallpapers and leathers. From the laboratory data, an estimate has been made of the rate of dry deposition on vegetation demonstrating that this is an efficient removal process. The observation that the uptake on limestone is particularly high when the surface is damp correlates with observed damage to limestone frescoes. The work on wallpapers and leathers has been carried out with the corresponding Manufacturers' Associations and has shown very clearly the importance of surface finishes and tanning procedures.

Absorption of Sulphur Dioxide on Particles

Although air pollution is known to have respiratory effects on man, pure sulphur dioxide appears to have little. One theory is that SO_2 can only penetrate to the alveoli when attached to particles. Experiments in an aerosol chamber show that at equilibrium the proportion of gas-phase SO_2 absorbed varies from 1.3 per cent on tobacco smoke to 0.04 per cent on the natural aerosol taken on a relatively unpolluted day.

The Medical Research Council's Air Pollution Research Unit

The following notes describe briefly the current work on air pollution being done by the M.R.C. at St. Bartholomew's Hospital Medical College. For convenience the work is described in outline under various headings but it will be realised that the method of presentation does not mean that the topics are being investigated in isolation. The various investigations are highly integrated and it should be stressed that there is excellent liaison between the M.R.C. Air Pollution Unit, other M.R.C. units and outside bodies. The unit has been designated as the World Health Organisation International Reference Laboratory on Air Pollution.

Chemistry and Physics

As a prerequisite to the proper study of the effects of pollution much work is still being done on the chemical and physical nature of pollutants and methods for their determination.

Optical Assessment of Particulate Pollution

Optical methods are widely used to assess airborne particulate matter. In particular, smoke is commonly measured by the soiling of filters, but the techniques used are not the same everywhere and the measurements are interpreted on a purely empirical basis. It is therefore often difficult to compare results from different parts of the world, and even in this country to compare samples taken at the same place at different times, because the blackness of the particulate matter in the air is changing all the time as the Clean Air Act takes effect. The optics of the assessment of soiling, and the effect of the geometrical distribution of smoke particles collected on filters on the results obtained, have been studied, with a view to gaining a better understanding of the phenomena affecting the measurements. This understanding is a necessary preliminary to comparison of results obtained by different workers and to the development of methods better suited to present needs. Further work on the optics of particles deposited on glass slides is under way.

Studies on Carcinogens

Our interest in 3:4-benzpyrene and other polycyclic hydrocarbons is declining since not only are their concentrations in air now decreasing but the evidence that they are associated with lung cancer is much weaker than it was some years ago. Some studies on the stability of these hydrocarbons have shown that some of them appear to be destroyed by ultraviolet light and nitrogen dioxide. Investigation into the sources of polycyclics has shown that the relative proportion of certain hydrocarbons can vary; using a ratio of coronene to 1:2-benzpyrene (two stable hydrocarbons) it has been possible by analysing samples of collected smoke to identify sources of hydrocarbons such as coal fires and motor vehicles. A study into the production of hydrocarbons from burning fuels has shown that the above hydrocarbon ratio increases markedly as the combustion efficiency increases.

Asbestos

Asbestos can no longer be considered to be merely a pollutant of industrial atmospheres; recent work on the prevalance of mesotheliomas has shown the need to study it as an urban pollutant. Samples of asbestos which have been shown to be highly carcinogenic to rats have been examined for organic material. A number of constituents have been identified including trace amounts of 3:4-benzpyrene, and paraffinic hydrocarbons, a high proportion of which latter compounds come from the polythene bags with which the asbestos has been in contact, and a quinoid oxidation product of an antioxidant present in the polythene. The biological significance of contaminating substances associated with the asbestos has yet to be assessed.

Some preliminary studies on bulk samples of smoke collected in the City have been carried out in which the samples are extracted with organic solvents and ashed at low temperatures so that they can be examined with an electron microscope for asbestos fibres. A few asbestos-like fibres have been detected; examination using electron diffraction techniques is planned to help with the identification of such fibres.

Acid Particles

Acid particles, which may be of clinical significance, are very common in town air. Their source at times of low pollution appears to be the efficient combustion of fuels; past records show that at times of high pollution synthesis of acid takes place and that high concentrations of sulphur dioxide and smoke occurring together are important for the formation of much particulate acid.

Since sulphur trioxide vapour and sulphuric acid when inhaled are likely to have different physiological effects, some laboratory experiments are being carried out to determine how long the vapour can exist as such in air before it is converted to sulphuric acid.

Carbon Monoxide

Because of the many sources of carbon monoxide, its varying concentrations in air, and the fact that its absorption depends on exercise and time, the measurement of carboxyhaemoglobin is greatly to be preferred to measurement of CO in air. The simpler indirect methods of measuring carboxyhaemoglobin such as the measurement of alveolar air are being tested; this involves simply analysing carbon monoxide in exhaled air after breath-holding.

Electron Microscopy

Work is continuing on the depiction and identification of particulate pollutants by electron microscopy and electron diffraction, special attention being paid to asbestos. We have devised a method for treating samples of beer so that their residues can be examined for asbestos fibres using the electron microscope. This preparative technique could also be used for the study of asbestos fibres in samples of solid air pollutants.

Development of Instruments and Apparatus

An oscillating glass slide for use with the cascade impactor and thermal precipitator is under development. It is designed to obtain larger dust sample traces for the work on the optics of particles deposited in glass slides.

Equipment is to be made for the generation of monodisperse aerosols which will include an automatic dual syringe drive.

Apparatus for the study of surface active materials is being developed.

The improvement and automation of lung function measurements is being studied with special reference to ways in which a digital computer may be used to accept and process signals from the whole body plethysmograph and other apparatus.

Physics of the Lung and Measurement of its Function

The fundamental study of the lung as a physical system is enabling us to reassess the methods of measuring its function in health and disease. In the past, studies to determine the physiological effects of environmental pollutants have been hampered by the lack of a very sensitive test to assess the effects of respiratory insult, and as part of the search for a more refined technique, we are developing new methods of assessing respiratory function. The analysis of continuous respiratory waveforms is being studied using the unit's own on-line digital computer to process the physiological data.

Studies of Acute Effects of Inhalation of Pollutants

Very many combinations of gases and aerosols of different composition have been inhaled in order to study their effects on airway resistance and gas diffusion. As yet no consistent responses have been seen to follow exposures to realistic concentrations in the laboratory.

Daily measurement of airway resistance following exercise has shown some correlation with pollution and this is being studied carefully.

Daily measurements of simple indices of pulmonary ventilation have been made for a five-year period on healthy volunteers but no consistent relation with pollution has been found. Measurement of peak expiratory flow rate on selected bronchitic patients continue and there is an indication that sensitivity to high peaks of pollution decreases as the winter goes on.

We are making long term cohort studies of lung function and respiratory symptoms on medical students to see if early signs of the development of chronic bronchitis is related to pollution, smoking habits, changes in residence, age and athleticism.

Carbon Monoxide

Following the development of the micro-method for determining CO in blood (mentioned above) surveys of blood levels have been made in people exposed occupationally or experimentally to traffic. These have shown, so far, that levels above four per cent saturation with carboxyhaemoglobin are rarely attained in non-smokers but levels higher than this (not uncommonly greater than 10 per cent) are frequent in smokers. These surveys are being extended.

Experimental work is being done on the possible effects of carbon monoxide, producing a saturation of up to 10 per cent, on the performance of fine tasks and on vigilance. So far the results have shown no perceptible effects of such saturations on flicker and flutter fusion thresholds. Work on more complex tests is being done.

Physiology, Bacteriology and Histology

Effect of Irritant Atmospheres in the Chemical Industry on Bronchial Mucosa

We have arranged that samples of lung and bronchi from post mortem and biopsy material be sent to us for histological examination to assess the degree of mucosal hypertrophy. The material comes from I.C.I. employees and is examined "blind" in that their occupational exposure to irritants is not known. The work is designed to test the hypothesis that chronic bronchitis is not mainly caused by exposure to such simple chemical irritants as SO_2.

Bacteriology, Effects of Pollutants on Lung Flora

It has been suggested that pollution in town air is responsible for the greater prevalence of chronic bronchitis in towns compared with country districts. As part of our investigations into the possible relationship between air pollution and bronchitis we have been studying the effects (in vitro) of particulate pollutants collected from London air on the growth of some organisms found in the respiratory tract—Strep. viridans and Staph. aureus—and those commonly recovered from the sputum of patients with chronic bronchitis—Strep. pneumoniac and H. influenzae. Our experiments have shown that solid pollutants can not only inhibit bacterial growth on blood agar plates but they can also cause growth stimulation of H. influenzae. A chemical separation of pollutants has shown that the growth inhibitor is mainly in the water soluble fraction and the stimulator is in the organic soluble fraction. Studies so far suggest that the factors present in pollutants are not capable of replacing "X" or "V" as growth requirements but probably act indirectly through an effect on the medium.

Epidemiology

Our efforts to determine whether the marked improvement in pollution conditions in London during recent years have led to any corresponding improvements in health are continuing. There is now little evidence of any association between daily death rates, hospital admissions and pollution. This is due largely to the absence of periods of high pollution in recent years; we would not expect smoke to reach high values any more but there is good reason to believe that high concentrations of sulphur dioxide would still occur in temperature inversions. It may be however that the absence of a blanket of smoke and the increased turbulence introduced by tall buildings has reduced the risk of temperature inversions persisting through the daytime hours. Our latest "diary" study, in which patients who had responded consistently to changes in pollution in an earlier winter were again asked to record changes in their conditions on a daily basis, has also failed to demonstrate any marked effects of pollution.

These results are encouraging, but we could not claim yet that the acute effects of pollution in London have been eliminated. We may merely have been lucky with the weather in recent winters, and the examination of daily death rates and hospital admission data will continue.

Studies on chronic effects also show encouraging signs; bronchitis mortality is beginning to decline again, particularly in London, and although the improvement may be due partly to changes in smoking habits and to improved therapy the situation is being watched carefully in relation to changes in pollution.

Studies of the epidemiology of lung cancer continues and, as evidence accumulates and is analysed, it is becoming increasingly apparent that cigarette smoking is of overwhelming importance as the main cause of the disease and the role of air pollution would appear to be minimal.

An earlier study had shown that chest illness was commoner in children who had lived in polluted environments, and further work is now in progress to determine whether exposure to urban air pollution in infancy has any detectable effect on lung function in later life.

Extensive use is made of large-scale computing facilities for all this work, and files of data are maintained on magnetic tape.

The International Union of Air Pollution Prevention Associations

The International Union was originally established in 1965 with six founder members—United States of America, Argentina, France, Great Britain, Japan and West Germany. The Union consists of non-governmental organisations only and its primary functions are to promote collaboration and the exchange of information on air pollution and environmental problems and to organise, through its member associations, international congresses.

The first congress of the Union was held in London in 1966; the second International Clean Air Congress was held in Washington D.C., U.S.A. from 6th December to 11th December 1970 and the third International Congress will be held in Dusseldorf, West Germany in the autumn of 1973.

The President of the I.U.A.P.P.A., the third one to hold office, is Herr Hans Stephany of V.D.I.—Kommission Reinhaltung der Luft, of West Germany; the Secretary of the International Union is Herr J. Kramer.

Since its inception in 1965 the I.U.A.P.P.A. has now grown to eleven full corporate members and five affiliate members.

Corporate Members:

Asociacion Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires, Argentina.

Clean Air Society of Australia and New Zealand, One Parker Close, Beecroft, N.S.W. 2119, Australia.

Associação Brasileira de Prevençao à Poluição do Ar, Departamento de Saúde Ambiental, Faculdade de Saúde Publica, Caixa Postal 8099, Sáo Paulo, Brazil.

Association Pour La Prévention de La Pollution Atmosphérique, 62 Rue de Courcelles, Paris 8e, France.

VDI-Kommission Reinhaltung der Luft, Graf-Recke Strasse 84, Postfach 1139, 4 Dusseldorf 1, Federal Republic of Germany.

National Society for Clean Air, 134-137 North Street, Brighton BN1 1RG, Great Britain.

Kanto-Shin-Etsu Heat Control Society, 54 Takata-Oimatsu-cho, Bunkyo-ku, Tokyo, Japan.

Asociacion Mexicana Contra la Contaminacion del Agua y del Aire, A.C., Toree de Ciencias 50 Piso, Ciudad Universitaria, México 20, D.F., México.

SICOM, Stichting International Contactorgaan Milieubescherming, Postbus 214, Delft, The Netherlands.

Schweiz. Vereinigung für Gesundheitstechnik (SVG), Postfach 305, 8035 Zurich, Switzerland.

Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pa., 15213, U.S.A.

Affiliate Members:

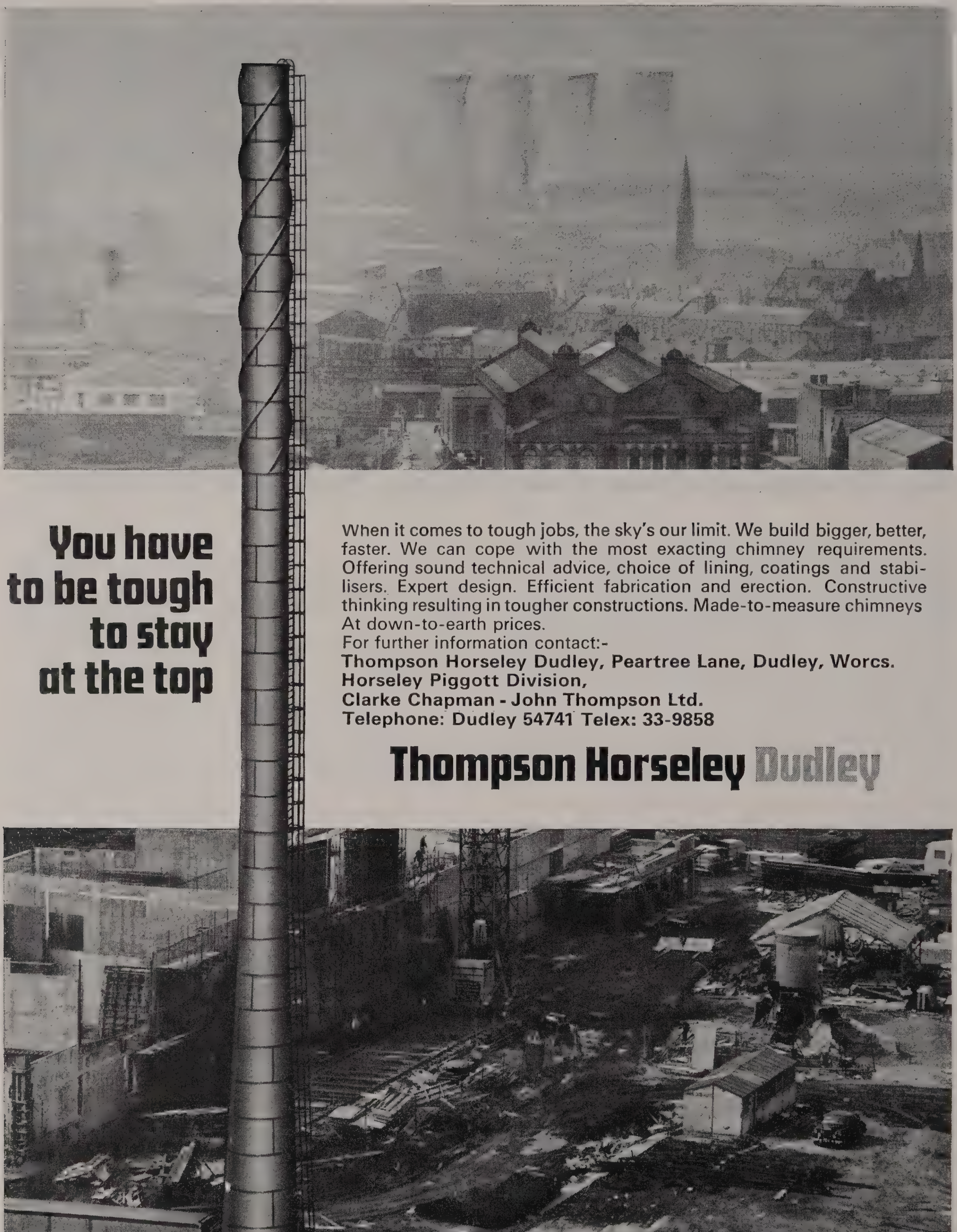
Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.), Den Norske Ingeniørforening, Kronprinsensgate 17, Oslo 2, Norway.

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire, Jr, Moquegua 336 - Of. 206, Lima, Peru.

National Association for Clean Air, P.O. Box 2276, Johannesburg, Transvaal, South Africa.

Asociacion Uruguaya Contra la Contaminacion del Aires, Calle Colonia 1422, P.6, Ap. 601, Montevideo, Uruguay.

Yugoslav Commity for Chemical Engineering, Section of Air Pollution Prevention, Sarajevo, Omladinsko šetaliste bb, Yugoslavia.



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AN OUTLINE OF THE LAW RELATING TO AIR POLLUTION

The control of air pollution in Great Britain is essentially a team effort involving Local Authorities, the Department of the Environment (including the Alkali Inspectorate), Police Authorities (in respect of road vehicle emissions) and the Factory Inspectorate (in respect of dusts and toxic fumes, etc., in factory atmospheres).

The principal legislation in Great Britain (excluding Northern Ireland) is contained in the Clean Air Acts 1956 and 1968, but some of the "nuisance" provisions of the Public Health Act 1936, extended and amended by the Public Health Act 1961 and the Public Health (Recurring Nuisances) Act 1969, are applicable in specified circumstances. The domestic smoke control area provisions of the Clean Air Act 1956 were amended by section 95 of the Housing Act 1964 and further amended by the Clean Air Act 1968.

The provisions of the Clean Air (Northern Ireland) Act of 1964 are largely identical to those of the 1956 Act.

The control of "noxious or offensive gases" from some 59 different classes of works registrable under the provisions of the Alkali &c. Works Regulation Act 1906 and the Alkali &c. Works Order 1966 is exercised by the Alkali Inspectorate of the Department of the Environment (see the section on page 39 on the Alkali &c. Works Regulation Act).

Action may also be taken under Common Law procedure by anyone who suffers nuisance from air pollution, and in this way it may be possible to secure damages and/or to obtain an injunction.

There are also a number of Private Acts of Parliament in which some local authorities possess powers to deal with smoke emission, to establish smokeless zones and to grant optional prior approval of proposed new industrial fuel burning installations. Most of these provisions, although they may remain in force, have now been superseded by the provisions of the Clean Air Acts 1956 and 1968. The control of pollution from road vehicles is exercised by the police under the provisions of the Road Traffic Acts and the Motor Vehicles (Construction and Use) Regulations 1969, a note of which is to be found on a later page.

The following outline of current legislation, which necessarily omits much detail, gives the main provisions of the Clean Air Acts 1956 and 1968 and supporting Acts under the main subjects of "smoke", "chimney heights", "grit, dust and fume" and "miscellaneous provisions".

1. THE CONTROL OF SMOKE

A Definition of "dark" and "black" smoke:

Where legal standards of emission are prescribed for smoke, they refer to "dark" and "black" smoke. These are defined in the 1956 Act, and in Regulations, by reference to a shade on the British Standard Ringelmann Chart (see page 43) as:

> "Dark" smoke (defined in S.34 of the 1956 Act) means smoke which if compared . . . with the Ringelmann Chart would appear to be as dark as or darker than shade 2 on the chart.
>
> "Black" smoke (defined in the Dark Smoke (Permitted Periods) Regulations 1958; and in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958) means smoke which, if compared . . . with the Ringelmann Chart, would appear to be as dark as or darker than shade 4 on the chart.

B Use of Aids in Assessing Smoke Colour:

Although legislation defines dark and black smoke by reference to colour shades on the Ringelmann Chart, the use of the Chart is not compulsory. S.34(2) of the 1956 Act says that "For the avoidance of doubt, it is hereby declared that . . . the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type."

C Design Standards for New Plant

Section 3 of the Clean Air Act 1956 requires all new furnaces (other than domestic boilers with a rating less than 55,000 Btu/hr.) to be, so far as practicable, capable of operating continuously without emitting smoke when burning fuel of a type for which the furnace was designed.

There is no definition of "furnace", but a practical interpretation of this word wherever it appears in Clean Air legislation, is usually taken as "any enclosed or partly enclosed space in which liquid, solid or gaseous matter is burned, or in which heat is produced".

It is a requirement of this section that the proposed installation of all new furnaces (other than domestic boilers rated at less than 55,000 Btu/hr.) *must* be notified to the local authority, and if one wishes to do so, one may apply for local authority approval that the proposed unit is capable of substantially smokeless operation. The approval does not, however, allow indiscriminate smoke emission and the furnace must be operated to ensure that permissible emissions are not exceeded.

D Standards for Smoke Emission:

Section one of the Clean Air Act 1956 prohibits the emission of dark smoke from a chimney, but also allows the Secretary of State for the Environment to make regulations exempting prescribed lengths of emission from possible action under this section.

The "permitted emissions" are prescribed in the Dark Smoke (Permitted Periods) Regulation 1958: and the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958.

D(1) The Dark Smoke (Permitted Periods) Regulations 1958 (Statutory Instrument 1958 No. 498)

(*a*) Aggregate emissions of dark smoke.

Number of furnaces served by the chimney	*Permitted emission of dark smoke in any period of eight hours*	
	If not soot blowing during period	*If soot blowing during period*
One	10 mins.	14 mins.
Two	18 mins.	25 mins.
Three	24 mins.	34 mins.
Four or more	29 mins.	41 mins.

Where a single boiler or unit of industrial plant is fired by more than one furnace discharging into the same chimney, those furnaces shall be deemed to be one furnace.

(*b*) Continuous emissions of dark smoke

The continuous emission of dark smoke in excess of four minutes, caused otherwise than by soot blowing, is prohibited.

(*c*) Aggregate emission of black smoke

No emission of black smoke exceeding two minutes aggregate in any period of thirty minutes is allowed.

There are thus three standards of emission which are acceptable in relation to any one chimney. The penalty for an offence under section one of the Act is a fine not exceeding £100 for each day on which the offence occurs.

D(2) The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (Statutory Instrument 1958 No. 878)

By the provisions of section 20 of the 1956 Act, vessels in waters not navigable by sea-going ships and in certain waters within the seaward limits of the territorial waters of the United Kingdom, must comply with the dark smoke provisions of section one of the 1956 Act, subject to the permitted emissions contained in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958, as follows:—

Class of Case	*Permitted Period for Emission of Dark Smoke*
1. Emissions from a forced draught oil-fired boiler furnace, or an oil engine.	10 minutes in the aggregate in any period of 2 hours.
2. Emission from a natural draught oil-fired boiler furnace (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
3. Emissions from a coal-fired boiler furnace:—	
(*a*) when the vessel is not under way (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
(*b*) when the vessel is under way.	20 minutes in the aggregate in any period of one hour.
4. Emissions from a natural draught oil-fired boiler furnace or a coal-fired boiler furnace in the following cases:—	
(*a*) a vessel with funnels shortened for the purpose of navigating the Manchester Ship Canal;	20 minutes in the aggregate in any period of one hour.
(*b*) a tug not under way, but preparing to get under way or supplying power to other vessels or to shore installations;	
(*c*) a vessel not under way but using main power for the purpose of dredging, lifting, pumping or performing some other special operation for which the vessel is designed.	
5. Emissions from any other source.	5 minutes in the aggregate in any period of 1 hour.

A vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground shall be deemed to be under way. The Regulations include a proviso that:

(*a*) **continuous emissions of dark smoke caused otherwise than by the soot blowing of a water tube boiler shall not exceed**
  (i) in the case of classes 1 and 2, 4 minutes;
  (ii) in the case of natural draught oil-fired boiler furnaces in class 4, 10 minutes; and
  (iii) in no case shall black smoke be emitted for more than 3 minutes in the aggregate in any period of 30 minutes.

D(3) Defences for excessive dark and black smoke emission

Section one of the 1956 Act contains three defences which may be available if an occupier of premises is proceeded against for dark/black smoke emission. These briefly are that the emission was solely due to
  (*a*) lighting a furnace from cold;
  (*b*) unavoidable mechanical breakdown;
  (*c*) unavoidable use of unsuitable fuel; and
  (*d*) any combination of (*a*), (*b*) and (*c*).

These are not absolute defences and are available only if every practical effort is made to avoid the emission.

E Emissions of Dark Smoke from "Bonfires", etc.

On 1st October 1969 Section one of the Clean Air Act 1968 became operative. This section prohibits (subject to prescribed exemptions) the emission of dark smoke from industrial or trade premises (as distinct from chimneys) and is concerned mainly with preventing excessive smoke emission caused by the indiscriminate burning of industrial or trade refuse in the open, but this section will also control dark smoke emissions from industrial processes not having a chimney.

In this connection, "industrial or trade premises" means premises normally used for industrial or trade purposes, or premises not normally so used, but which, at the time of the offence, were being used for industrial or trade burning.

The Secretary of State has made the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 which exempt the emission of dark smoke caused by the burning of the following materials, subject to the specified conditions:—

Exempted Matter

(1) *Matter*	(2) *Conditions*
1. Timber and any other waste matter (other than natural or synthetic rubber or flock or feathers) which results from the demolition of a building or clearance of a site in connection with any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961).	Conditions A, B and C.
2. Explosive (within the meaning of the Explosives Act 1875) which has become waste; and matter which has been contaminated by such explosive.	Conditions A and C
3. Matter which is burnt in connection with (*a*) research into the cause or control of fire or (*b*) training in fire fighting.	Condition C
4. Tar, pitch, asphalte and other matter which is burnt in connection with the preparation and laying of any surface, or which is burnt off any surface in connection with resurfacing, together with any fuel used for any such purpose.	Condition C
5. Carcases of animals or poultry which (*a*) have died, or are reasonably believed to have died, because of disease; (*b*) have been slaughtered because of disease; or (*c*) have been required to be slaughtered pursuant to the Diseases of Animals Act 1950.	Conditions A and C, unless the burning is carried out by or on behalf of an inspector (within the meaning of Section 84 of the Diseases of Animals Act 1950).
6. Containers which are contaminated by any pesticide or by any toxic substance used for veterinary or agricultural purposes; and in this paragraph "container" includes any sack, box, package or receptacle of any kind.	Conditions A, B and C

The conditions referred to in column 2 are:—

CONDITION A That there is no other reasonably safe and practicable method of disposing of the matter.
CONDITION B That the burning is carried out in such a manner as to minimise the emission of dark smoke.
CONDITION C That the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on his behalf.

F **Smoke Control Areas:**

Sections 11 to 15 of the Clean Air Act 1956, Sections 8 to 10 of the 1968 Act and Section 95 of the Housing Act 1964 relate to Smoke Control Areas, the administrative procedures, and the enforcement of Smoke Control Orders.

Section 11 of the 1956 Act allows a Local Authority to make a Smoke Control Order which must be submitted to the Secretary of State of the Environment for confirmation. When operative it is an offence for an occupier of premises to allow smoke emission from a chimney, unless the smoke is caused by the use of an "authorised fuel"; or the "fireplace" which the chimney serves is exempt from the Order.

The Clean Air (Authorised Fuels) Regulations 1956, 1963, 1965, 1969 and 1970 (No.2), allow the use of the following fuels in Smoke Control Areas, even though some may for short periods cause light smoke emission:—

Anthracite	
Low Volatile Steam Coal	
Phurnacite	Manufactured Solid Smokeless Fuels
Burnbrite	
Cleanglow and Phimax	
Coalite, Rexco and Rexco Ovoids	
Gloco and gas coke	
Homefire	
Multiheat and Roomheat	
Sunbrite and 'hard' coke	
Cosiglow	
Fireglo	
Maxiglow	
Gas and electricity	

A number of other solid smokeless fuels are currently undergoing test to determine whether or not they should be authorised.

The Smoke Control Areas (Exempted Fireplaces) Order 1970 (Statutory Instrument 1970 No.615) and the Smoke Control Areas (Exempted Fireplaces) (No.2) Order 1970 (Statutory Instrument 1970 No.1667) conditionally exempt the emission of smoke from chimneys serving the following fireplaces:

Class of Fireplace	*Conditions*
A. **1970 Order**	
1. Any fireplace specially designed or adapted for combustion of liquid fuel.	
2. Any fireplace (other than a fireplace fired by pulverised fuel) constructed on or after 31st December 1956 and installed before 1st May 1970 and equipped with mechanical stokers, or adapted between those dates for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
3. Any fireplace designed to burn coal (other than a fireplace fired by pulverised coal) with a heating capacity exceeding 150,000 Btu/hr. constructed and installed on or after 31st December 1956 and equipped with mechanical stokers or adapted on or after that date for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
4. The fireplace known as the Solid Fuel Ductair Unit, manufactured by Radiation Limited.	
5. The fireplace known as the Fulgora Slow Combustion Stove, manufactured by Fulgora Stoves Limited.	No fuel shall be used other than wood waste in clean condition.
6. The fireplace known as the Housewarmer, manufactured for the National Coal Board by Ideal Standard Limited.	No fuel shall be used other than washed coal singles.
7. The fireplace known as the Wood Chip Fired Air Heater, manufactured by Air Plants Ltd.	No fuel shall be used other than clean wood waste of a size within the limits referred to in the manufacturer's instructions.
8. The fireplace known as the Hounsell Sawdust Burning Stove, manufactured by John Hounsell (Engineers) Limited.	No fuel shall be used other than wood waste in clean condition.
B. **1970 (No.2) Order**	
The fireplace known as the Triancomatic T.80.	No fuel shall be used other than selected washed coal singles.

In addition to the conditions above two standard conditions require all appliances to be installed, maintained and operated
- (i) so as to minimise the emission of smoke;
- (ii) in accordance with the manufacturer's instructions as to the operation (if any) or, in the case of the class of fireplace numbered 6 above, in accordance with such instructions of the National Coal Board.

The local authority may also include in the Smoke Control Order other exemptions, which they may feel are necessary, subject to reasonable conditions. One of these is to allow the lighting of domestic fires with sticks and paper if there is no gas in the dwelling.

Thus, coal, oil and waste wood may not normally be burnt either by a householder or an industrialist unless on an exempted appliance, the design of which has satisfied the Secretary of State that it is capable of being operated substantially smokelessly and is exempted by Statutory Instrument.

The 1968 Act extended the Smoke Control provisions of the 1956 Act. The Minister is now empowered to require a local authority to make Smoke Control Orders. It is also an offence to acquire or to sell by retail for delivery in a Smoke Control Area any fuel other than an authorised fuel, unless in each case the premises or fireplace are exempt.

The financial provisions of the 1956 Act require the local authority to pay to owners or occupiers of dwelling houses a grant of 7/10ths of the reasonable cost of fireplace adaptations, and they may repay all or any part of the remaining 3/10ths. The local authority recovers 4/7ths of the grant from the Exchequer. A grant is not available in respect of a "new dwelling" begun on or after 16th August 1964.

The Housing Act 1964 allows a local authority to "designate" as unsuitable any appliances for which suitable fuels are not fully available, and in those circumstances a grant is not available for installation of those appliances.

Section 10 of the 1968 Act prevents a local authority from postponing the operation of a Smoke Control Order by more than 12 months.

Grant Arrangements

The principles which local authorities must follow in assessing eligibility of works of adaptation for grant are contained in the Memorandum on Smoke Control Areas revised by the Department of the Environment Circular 51/65. In Circular 32/71 the Department set cost limits for local authority guidance in assessing "reasonable costs":—

Smoke Control Area Grants: Cost Limits for Various Appliances (Circular 32/71)

	£
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar)	10
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar) with boiler	22*
Underfloor draught fire and fan assisted open fire	20
Underfloor draught fire and fan assisted open fire with boiler	30*
Solid fuel room heater	35
Solid fuel room heater with boiler	45*
Gas room heater	32
Electric thermal storage heater	35
Direct acting electric space heater	22
Oil room heater	32
Solid fuel cooker with boiler	80
Gas or electric cooker	48
Independent solid fuel boiler, **including installation**	32
Gas water heater (e.g. gas circulator and back boiler unit), **including installation**	32
Electric immersion water heater, **including installation**	22
Wash boiler, gas and electric	20
Gas poker, including flex and tap	3
Bottled gas igniter, if gas container is hired	4
Bottled gas igniter, including purchase of gas container	8
Electric kindler	10

*£3 may be added where
- (i) it would be impossible or inadvisable to connect the existing boiler to the new space-heating appliance, and
- (ii) either
  - (*a*) the existing boiler is itself bower-barffed or made of stainless steel, copper, aluminium, bronze or other superior material, or
  - (*b*) one of the above types is necessary to comply with local water bye-laws.

It is for the local authority to decide, within the appropriate level, what costs are reasonable in each case. In general the Department of the Environment will not accept as eligible for grant any expenditure which exceeds the stated limit.

G Statutory Procedure in the Event of an Offence for Excessive Smoke Emission

Section 30 of the 1956 Act requires the local authority authorised officer (usually the Public Health Inspector) to notify "as soon as may be" the occupier of the premises of the offence and to confirm his notification in writing within 48 hours of becoming aware of the offence.

This requirement applies to a contravention of Section one and eleven of the 1956 Act, i.e. Dark/Black smoke emission, and smoke emission in a smoke control area, and to Section one of the 1968 Act, i.e. dark smoke emission from industrial or trade burning. In any subsequent proceedings it is a defence to prove that the notification was not made "as soon as may be" or that the notification was not confirmed within two days following the date of offence.

H Statutory Smoke Nuisance:

Part III of the Public Health Act 1936 defines certain statutory nuisances, and prescribes the legal procedure for enforcing their abatement.

Section 16 of the Clean Air Act 1956 extends the provisions of Part III of the Public Health Act 1936, to include smoke nuisance, but a smoke nuisance cannot include:—

(i) smoke emitted from a chimney of a private dwelling, or
(ii) dark smoke from a chimney of a building or boiler or other plant (controlled by Section 1 of the 1956 Act), or
(iii) dark smoke caused by industrial or trade burning (controlled by Section 1 of the 1968 Act).

Where a smoke nuisance exists, the local authority may pursue the lengthy and cumbersome nuisance procedure, but if they are satisfied that the nuisance has occurred, has temporarily ceased, but is likely to recur, they may, without serving an Abatement Notice, cause a complaint to be made to the Magistrate's Court for the making of a Nuisance Order, following which the provisions of Part III of the Public Health Act 1936 for enforcement of the Order will apply.

Summary of the provisions relating to smoke emission

1. New plant must be capable of substantially smokeless operation.
2. The proposed installation of new furnaces must be notified to the local authority.
3. There are permitted periods for dark and black smoke emission from chimneys, and these standards apply throughout England and Wales.
4. The Permitted Periods Regulations apply whether or not premises are subject to a Smoke Control Order, but additionally, if in a Smoke Control Area, the occupier must ensure that smoke emission is prevented, or, where plant or premises are conditionally exempted, he must ensure that smoke emission is minimised.
5. A grant of 7/10ths of reasonable expenditure is available for the adaptation or replacement of domestic coal burning and similar open fires in a Smoke Control Area.
6. Dark smoke emission from bonfires, etc., on industrial or trade premises is, subject to exemptions, prohibited.
7. The authorised officer must notify the occupier of premises as soon as may be of the existence of an offence, and must confirm his notification in writing within 48 hours.
8. Smoke, other than smoke emitted from a dwelling, dark smoke from a chimney or dark smoke from industrial or trade burning, may if it causes a nuisance be regarded as a Statutory Nuisance under the Public Health Acts.

2. THE CONTROL OF CHIMNEY HEIGHTS

At whatever height smoke and flue gases are discharged, gravity will eventually bring the larger particles of grit, dust and soot to the ground. Additionally, because of the natural turbulence of the atmosphere, a proportion of the gases and of the freely suspended fine particles will reach the ground although not affected by gravity. The higher the point of discharge and the greater the total heat content of the discharge gases, the more widespread and diluted will be the fine particles and gases by the time they reach ground level.

The Legal Control of Chimney Heights

The legal control of chimney heights enables the local authority to take into account a number of relevant factors in determining the height of a chimney to avoid down draught or down wash created by the chimney itself, by buildings or topographical features, and to avoid the ground level concentration of the products of combustion from becoming prejudicial to health or a nuisance, or in the case of smaller units to prevent the flue gases from entering nearby buildings in too high a concentration. All chimneys must comply with the structural requirements of the Building Regulations 1965, but the control of the height or position of the terminal is now exercised under the provisions of the Clean Air Act 1968 or the Building Regulations 1965, according to the fuel consumption of the plant served by the chimney. Further control is available in the Public Health Act 1961 when a new building is proposed which will over-reach the chimney of an adjacent building and affect the dispersal of the products of combustion.

A The Clean Air Act 1968—Section 6

This section of the 1968 Act amends and extends the provisions of Section 10 of the Clean Air Act 1956, which it has largely replaced (except to control the height of chimneys serving non-combustion processes).

Whereas by Section 10 of the 1956 Act a local authority could control a chimney height only if building plans indicating a proposal to erect a chimney were submitted for approval, it must now, under the new provisions, consider a chimney height when:—

(i) a new chimney is erected to serve a new or existing furnace,
(ii) a furnace served by an existing chimney is enlarged, i.e. when its combustion space is increased, e.g. by the addition of a new furnace to an existing range of furnaces,
(iii) a furnace served by an existing chimney is removed and replaced by one having a larger combustion space,

but only if the furnace:—

(*a*) burns or is to burn pulverised fuel; or
(*b*) burns or is to burn at a rate of 100 lbs. or more an hour any other solid matter; or
(*c*) burns or is to burn at a rate equivalent to 1¼ million Btu or more per hour any liquid or gaseous matter.

An application for chimney height approval should be on the form prescribed in the Clean Air (Heights of Chimneys) (Prescribed Form) Regulations 1969 (Statutory Instrument 1969 No. 412) but this does not preclude the local authority from considering an application even though not on the prescribed form, if the information provided by the applicant is sufficient.

The local authority must consider an application and give a written decision within 28 days of receiving the application, unless it is agreed in writing between the local authority and the applicant that a longer period may be allowed; the local authority, however, must not approve the proposed chimney height unless they are satisfied that it will be sufficient to prevent, so far as is practicable, the smoke, grit, dust, gases or fumes emitted from the chimney from becoming prejudicial to health or a nuisance, having regard to:—

(i) the purpose of the chimney,
(ii) the position and descriptions of buildings near to it,
(iii) the levels of the neighbouring ground,
(iv) any other matters requiring consideration in the circumstances.

Any approval of the height of a chimney may be granted unconditionally or subject to conditions as to the rate and/or quality of emissions from the chimney.

> "rate of emission" is defined as the quantities of any specified substance which may be emitted in a period specified in the conditions attached to the approval, e.g. lbs./hr. of sulphur dioxide.

Many other miscellaneous emissions may, of necessity, be considered for inclusion in conditions as to the rate of emission, but there will be cases where a limitation on "rate" alone will not sufficiently ensure against excessive pollution by materials other than normal combustion products, and in those cases it might be appropriate to impose conditions as to the "quality" (i.e. concentration) of the emission.

A limitation on the quality of emission would be appropriate if the products of combustion contain gases or acid mists resulting from abnormal reactions or breakdown of materials derived from chlorinated or sulphur bearing compounds, etc., or if products of combustion are mixed with waste gases from non-combustion processes.

There will also be occasions, particularly in relation to metallurgical processes, where the optical density of emissions may be regulated by reference to percentage obscuration or perhaps by reference to the Bacharach scale.

If a local authority fails to give a written decision within 28 days, the approval applied for is deemed to be granted without qualifications.

If the local authority decide not to approve the height of a chimney or to attach conditions to their approval, they must give the applicant a written notification of their decision, stating their reasons, and they must additionally specify the lowest height, if any, which they are prepared to approve unconditionally and/or the lowest height they are prepared to approve with any specified conditions. The applicant may, within 28 days, appeal against the decision to the Secretary of State for the Environment, or the Secretary of State for Wales or for Scotland as appropriate.

In the event of an appeal being lodged, the Secretary of State may confirm the decision against which the appeal is made, or may amend the height or conditions as he thinks appropriate. He must also give a written notification of his decision stating his reasons and, where he does not approve a chimney height, specifying what height, with and/or without conditions, he would approve.

It is not necessary to apply for chimney height approval for any exempted boiler or plant, and the Secretary of State has made the Clean Air (Heights of Chimneys) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 411).

These Regulations provide in substance that chimney height approval is not required where a boiler or plant is used:—

(i) as temporary replacement for a boiler or plant which is under inspection or being maintained, repaired, rebuilt, or replaced by another permanent boiler or plant;
(ii) as a temporary source of heat or power for building or engineering construction work;
(iii) as a temporary source of heat or power for investigation or research;
(iv) as an auxiliary plant used to bring other plant to an operating temperature;
(v) as a mobile or transportable source of heat or power for agricultural operations.

Although a boiler or plant, when used wholly for one of the prescribed purposes, will be exempt from the provisions requiring the height of the chimney to be approved, it will nevertheless be subject to the other relevant provisions of the Clean Air Acts, and to the nuisance provisions of the Public Health Act 1936.

The Practical Determination of the Height of Chimneys Controlled Under the Clean Air Act 1968

Products of combustion emitted from chimneys serving furnaces burning conventional solid, liquid or gaseous fuels may contain:—

(*a*) *Solids*
Smoke, dust, ash, grit, fume.
(*b*) *Gases*
Carbon monoxide, carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen, hydrocarbons, oxygen and nitrogen; and a number of other minor constituents, including a host of trace elements.

By good combustion and the installation of efficient arrestors, the emission of solids, and to a lesser extent some of the gases, can be minimised, but removal of, for instance, sulphur dioxide is impracticable and the gases must therefore be discharged through a chimney of adequate height.

The basic thesis in the use of tall chimneys for waste gas dispersal is that there are no such things as dangerous gases or fumes, only dangerous concentrations.

The function of the chimney is to reduce the resulting ground level concentration of each constituent of the emission so that it is below the threshold which gives rise to a health hazard or a nuisance.

Under ideal conditions, and so far as gases are concerned, the ground level concentrations from a chimney discharge vary directly with the mass rate of emission and inversely with the wind speed and the square of the effective chimney height. Maximum ground level concentrations occur at about 10–15 times effective chimney heights distance.

Until the first edition of the Memorandum on Chimney Heights issued by the Ministry of Housing and Local Government in 1963, local authorities had a number of formulae which they could use for the calculation of a chimney height, particularly those recommended by the Beaver Committee in Appendix VI of its Final Report.

Revised in October 1967, the Memorandum on Chimney Heights still follows the basic principle in the amended edition that the pollution downwind from a chimney should not exceed a predetermined limit and that pollutants from the chimney must be considered in relation to pollution which exists from other sources.

Using either an average sulphur content for coal and oil of 1·6% and 3% respectively, or preferably using the known sulphur content, it is easy to calculate the mass emission of SO_2 (not forgetting that in the case of coal, 10% of the sulphur remains in the ash). In practice, because of the tremendous variation in sulphur content of coal it is usual to take the average of 1·6% for determining chimney heights, but to use the specification maximum for a particular class of oil when that fuel is to be used. It is also usual to base the fuel consumption on the maximum continuous rating of the boiler or other plant. Thus the chimney height is based on the maximum possible SO_2 emission from the plant and gives the industrialist some flexibility in the amount of fuel he might then burn without contravening the Act.

In the Memorandum, after the introduction of a description of the method, are printed a number of charts which allow firstly an uncorrected chimney height to be obtained based on SO_2 emission and the type of locality; and secondly a final height to be obtained by relating the uncorrected height to the height and/or length of the building in which the furnace is installed or the height of adjacent buildings.

An accurate assessment of the type of locality is important in determining the uncorrected chimney height, and the Memorandum gives the following guidance:—

(*a*) An undeveloped area where development is unlikely, where background pollution is low, and where there is no development within half a mile of the new chimney.
(*b*) A partially developed area with scattered houses, low background pollution, and no other comparable industrial emissions within a quarter of a mile of the new chimney.
(*c*) A built-up residential area with only moderate background pollution and without other comparable industrial emissions.
(*d*) An urban area of mixed industrial and residential development, with considerable background pollution and with other comparable industrial emissions within a quarter of a mile of the new chimney.
(*e*) A large city, or an urban area of mixed heavy industrial and dense residential development, with severe background pollution.

Category *c* represents average conditions, whilst categories *a*, *b*, *d* and *e* represent adjustments up or down, according to probable existing background pollution. Thus a chimney will be lower in Area *a* than in Area *c*, and highest in Area *e*.

It is emphasised that the Memorandum provides a relatively simple method of calculating the approximate chimney height commonly desirable in normal circumstances. There will sometimes, however, be occasions involving complex developments, or topographical complications, which are impossible to assess precisely by either experience or mathematics and it will then be necessary to have wind tunnel tests carried out on scale models.

Heights of Chimneys Serving Furnaces Not Burning Sulphur Bearing Fuels

The Memorandum can be utilised for determining stack heights only if the "fuel" contains sulphur in significant proportions, and there are no constituents of the chimney gases that are of more importance in relation to public health or nuisance than sulphur dioxide. Where there is no SO_2 emission, or where other constituents are of more importance, the height of the chimney cannot be assessed by use of the Memorandum on Chimney Heights. During 1970 the Warren Spring Working Group on Chimney Heights was reconstituted to produce a report recommending chimney heights for furnaces to burn natural gas, towns gas, liquid petroleum gas and low sulphur fuel oils. The working group is expected to produce its report during 1971.

B Clean Air Act 1956—Section 10

Although Section 10 of the 1956 Act no longer applies to a chimney serving a furnace, it will still apply to a chimney serving a non-combustion process, providing Building Regulation plans are required to be submitted for local authority approval. If the chimney is insufficient to prevent the emissions from becoming prejudicial to health or a nuisance, the local authority must reject the plans, and an aggrieved applicant may appeal to the Secretary of State for the Environment.

C The Building Regulations 1965

Where the proposed chimney is to serve plant with a fuel consumption lower than that specified for Clean Air Act control, the proposed chimney must comply with the requirements of the Building Regulations 1965 in that the terminal must be correctly sited.

The Regulations require a flue outlet to comply with stringent specific requirements if the appliance is not a "high rating appliance".

In the case of a high rating appliance, which is defined as:—

(i) a solid fuel or oil burning appliance with an output rating exceeding 150,000 Btu/hr.,
(ii) a gas appliance with an input rating exceeding 150,000 Btu/hr.,
(iii) an incinerator with a refuse combustion chamber exceeding 3 cu. ft. capacity,

control is exercisable only if the premises are offices, shops or dwellings, and in these cases the chimney terminal must be so situated as to prevent the discharge therefrom into the external air from entering any opening in a building in such concentration as to be prejudicial to health or a nuisance.

D Public Health Act 1961

Section 28 of this Act applies when a new building is erected which will overreach the chimney of an adjoining building.

Providing that the chimney of the lower building is in the party wall between it and the taller building, or is 6 feet or less from the taller building, the local authority may by notice require the person who erects the taller building to raise the height of the chimneys of the adjoining building if it is reasonably practicable to do so, so that the chimneys are the same height as the taller building or its chimneys, whichever is the higher.

The notice will also require the owner or occupier of the adjoining building to allow the work to be done, but he may elect to do the work himself and charge the reasonable cost of so doing to the person on whom the notice was served.

In the event of non-compliance with the notice, the local authority may do the work in default.

Chimney Design

It is essential to emphasise that whilst the physical and effective heights of any chimney are of importance in ensuring the eventual dispersion of the waste gases etc., other features of the chimney (e.g. its shape, quality of thermal insulation, and cross sectional area at the outlet) must be carefully designed if stack inversion, acid condensate, smut emission, and downwash are to be avoided.

Summary of the Provisions Relating to Chimney Heights

The occupier of premises must seek approval of a chimney height when:—

1. (i) a new chimney is to be erected,
   (ii) an existing furnace installation is to be enlarged,
   (iii) a furnace is to be replaced by one of larger combustion capacity,
   but only if the new or enlarged plant is to burn pulverised fuel; other solid matter at 100 lbs. or more per hour; or liquid or gaseous matter at 1·25 million Btu or more per hour.
2. The local authority must give a written decision within 28 days, and may prescribe conditions.
3. The applicant can appeal to the Secretary of State for the Environment within 28 days of receiving the local authority decision, if aggrieved by the decision or conditions.
4. Chimney height approval is not required for certain exempted plant—mainly of temporary or experimental nature.
5. If the proposed plant is below Clean Air Act size for chimney approval, but is a high rating appliance and is to be installed in office, shop or residential accommodation, the position and height of the chimney terminal must comply with the Building Regulations 1965.
6. In general the Ministry Memorandum on Chimney Heights is used, unless there are parameters more important than SO_2 emission which must be considered.
7. In some circumstances, the developer of a tall building may be required to raise the height of the chimneys of an adjoining building.

3. THE CONTROL OF GRIT, DUST AND FUME EMISSIONS

Although "grit" is defined in the Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 as "particles exceeding 76 microns in diameter", and "fume" is defined in the 1968 Act as "solid particulate matter smaller than dust", there is no definition of "dust".

It is, however, generally accepted that "dust is particulate matter smaller than 76 microns with a lower limit of one micron", and "fume" is sub-micronic in size.

Under the provisions of the 1956 Act the underlying principle in relation to stack solids was that any practicable means should be used for minimising grit and dust emissions. The various definitions recognised that technical problems would prevent the complete elimination of emissions and that the measures required would vary according to circumstances. The requirement for grit arrestors to be installed in connection with new plant related only to those burning pulverised fuel, or other solid matter at the rate of one ton or more per hour.

The provisions of the 1968 Act take these first principles a stage further and also allow the various provisions to be related to fume emission as and when the Secretary of State feels the time to be appropriate.

The new provisions considerably strengthen and extend the local authority powers in relation to this problem, and since they are of fundamental importance they are set down under a series of sub-headings.

A Power of the Secretary of State to Prescribe Limits of Emission

Section two of the 1968 Act gives the Secretary of State power to prescribe limits on the rates of emission of grit and dust from the chimneys of furnaces, and to prescribe different limits for different cases and according to different circumstances.

(i) Working Party on Grit and Dust Emissions

During 1964 the then Minister of Housing and Local Government was considering the possibility of making Regulations to enable local authorities to require industrialists to measure grit and dust emissions. He decided that before doing so it would be advisable for local authority staff to receive guidance as to the available methods of measuring grit and dust, and the levels of emission, from various types of plant, which would be acceptable. Accordingly a Working Party on Grit and Dust Emissions was convened with the following terms of reference:—

> "To consider ways and means of measuring grit and dust emissions and to advise on the levels of emission admissible in relation to furnaces burning fuel equivalent to 100 lbs. to 50,000 lbs. of coal per hour."

The Report, published in 1967 proposed limits on the acceptable levels of emission from coal fired and oil fired boilers, and from furnaces where the stock being heated does not contribute to the emissions.

The working party considered that there was insufficient reliable data of emissions from furnaces where the stock contributed to emissions, or from incinerators, and recommended that there should be initiated a systematic study to obtain emission data from a representative sample of these classes of furnaces and, at the same time, to obtain some reliable information on the current technology of emission prevention. This study has recently been undertaken by N.I.F.E.S.

Those recommendations included in the Report were stated in lbs./hour of grit and dust emitted during a period of normal operation, including peak loads. In the case of coal fired plant the acceptable emissions ranged from 1% of the fuel, fired at a low rate of burning (100 lbs./hour) to 0·5% of the fuel fired at the top rate of burning (50,000 lbs./hour); and in the case of oil fired plant the acceptable emissions reduced from 0·4% of the fuel fired at a low rate of burning to 0·2% of the fuel fired at the top rate of burning. In the case of coal fired plant the working party recommended that the percentage grit in the sample from plant burning up to one ton per hour should not exceed 33%, and from plant burning over one ton per hour should not exceed 20%.

The Report of the Working Party was later endorsed by the then Ministry of Housing and Local Government in its publication "Grit and Dust—The Measurement of Emissions from Boiler and Furnace Chimneys—Standard Levels of Emission."

(ii) The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (Statutory Instrument 1971 No. 162)

The Regulations were made on the 1st February 1971, and will come into operation on the 1st November 1971. They express in parliamentary and legal terminology the recommendations of the Working Party on Grit and Dust Emissions, but for a period until 1st January 1968 the Regulations will apply only to plant for which an agreement in respect of its purchase or installation was entered into after the date of operation i.e. there is a seven year exemption for existing installations.

The Regulations apply to:—

(*a*) boilers;
(*b*) indirect heating appliances (being heating appliances in which the combustion gases are not in contact with the material being heated);
(*c*) furnaces in which the combustion gases are in contact with the material being heated but that material does not in itself contribute to the grit and dust in the combustion gases.

The Regulations do not apply to incinerators burning refuse or waste matter (solid or liquid) whether or not the resulting heat is used for any purpose.

Schedules 1 and 2 of the Regulations tabulate the quantities of grit and dust which may be emitted, and where the rating of the boiler or furnace is intermediate between the tabulated values, the maximum permitted emission is obtained by interpolation:—

Schedule 1—Furnaces Rated by Heat Output

This schedule applies to boilers and also indirect heating appliances in which the material being heated is a gas or a liquid (e.g. an air heater) but where an indirect heating appliance falls also within the provisions of schedule 2, it shall be treated as schedule 1 furnace.

The amount of grit and dust which may be emitted is as follows:—

Max. Continuous Rating in lbs. of steam/hr. (from and at 100°C (212°F) or in thousands of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning solid matter	*Furnaces burning liquid matter*
825	1·10	0·25
1,000	1·33	0·28
2,000	2·67	0·56
3,000	4·00	0·84
4,000	5·33	1·12
5,000	6·67	1·4
7,500	8·50	2·1
10,000	10·00	2·8
15,000	13·33	4·2
20,000	16·67	5·6
25,000	20·0	7·0
30,000	23·4	8·4
40,000	30	11·2
50,000	37	12·5
100,000	66	18
150,000	94	24
200,000	122	29
250,000	149	36
300,000	172	41
350,000	195	45
400,000	217	50
450,000	239	54·5
475,000	250	57

Schedule 2—Furnaces Rated by Heat Input

This schedule applies to indirect heating appliances and to furnaces in which the combustion gases are in contact with the material being heated, but that material does not in itself contribute to the grit and dust in the combustion gases.

The amount of grit and dust which may be emitted is as follows:—

Heat input in millions of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning Solid Matter	*Furnaces burning Liquid Matter*
1·25	1·1	0·28
2·5	2·1	0·55
5·0	4·3	1·1
7·5	6·8	1·7
10	7·6	2·2
15	9·7	3·3
20	11·9	4·4
25	14·1	5·5
30	16·3	6·6
35	18·4	7·7
40	20·6	8·8
45	22·8	9·8
50	25	10·9
100	45	16
200	90	26
300	132	35
400	175	44
500	218	54
575	250	57

The Regulations limit the grit in the sample of grit and dust to the following proportions:—

	Grit not to exceed 33%	*Grit not to exceed* 20%
Schedule One Furnaces	Where maximum continuous rating does not exceed 16,800 lbs./hr. of steam or 16,800,000 Btu/hr.	In any other case.
Schedule Two Furnaces	Where designed heat input of the furnace does not exceed 25,000,000 Btu/hr.	In any other case.

Grit is defined as those particles exceeding 76 microns in diameter (i.e. will remain on a BS.200 mesh sieve).

Multiflue chimneys are defined and for the purpose of the regulations each flue is to be taken as a separate chimney for the purpose of calculating acceptable emissions.

Where a chimney serves a furnace to which the regulations apply and also a furnace to which the regulations do not apply, the emissions from the latter shall be disregarded.

The prescribed limits apply to any period of standard operation of the furnace, including periods during which it is at or close to the loading to which it is subject for the greater part of its working time, or at any higher loading to which it is regularly subject for a limited time (whether or not this exceeds the furnace M.C.R. or designed heat input).

N.B. (1) Until the Regulations are made to apply to existing furnaces, or additional Regulations are made for furnaces where the material being heated contributes to the grit and dust emission, the occupier of the premises must use "any practicable means" for minimising the grit and dust emission.

(2) If the grit and dust emission from a chimney serving a furnace to which the Regulations apply, exceeds the permitted limit, there is a defence that the "best practicable means" had been used to prevent the emission.

The definition of "practicable" in the 1956 Act (it applies also to the 1968 Act) is of importance:—

> "Practicable" means reasonably practicable having regard, amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge, and *"practicable means" includes the provision and maintenance of plant and the proper use thereof.*

B Arrestment Plant for New Furnaces

Section 6 of the Clean Air Act 1956 required that certain larger new furnaces, the installation of which was commenced (or was subject to an agreement signed) between July 1956 and October 1969, should be equipped with approved grit and dust arrestment plant and that the arrestors must be properly maintained and used. These provisions still apply to furnaces which are used:—

(i) to burn pulverised fuel; or

(ii) to burn, at a rate of one ton an hour or more solid fuel in any other form or solid waste,

providing that the plant was installed or an agreement was signed between the above-mentioned dates.

Section 3 of the 1968 Act states that if new plant is to be installed after the 1st October 1969 (or is subject to an agreement signed after that date) and it is to be used

(*a*) to burn pulverised fuel; or

(*b*) to burn, at a rate of 100 pounds or more an hour, any other solid matter; or

(*c*) to burn, at a rate equivalent to 1¼ million or more British thermal units an hour, any liquid or gaseous matter,

it must, unless exemption has been provided, be equipped with grit and dust arrestment plant. In the event of a local authority refusing approval there is a right of appeal to the Secretary of State within 28 days of receiving the local authority's written decision.

Two types of exemption are possible by virtue of Section 4 of the 1968 Act:—

(i) The Secretary of State has power to provide in Regulations that furnaces of any particular class, whilst used for a prescribed purpose, should be exempted. He has now made the Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 1262) as follows:—

Class of Furnace	*Purpose*
1. Mobile or transportable furnaces.	(*a*) Providing a temporary source of heat or power during any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961); (*b*) providing a temporary source of heat or power for investigation or research; (*c*) providing heat or power for the purpose of agriculture (within the meaning of section 109(3) of the Agriculture Act 1947).
2. Furnaces, other than furnaces designed to burn solid matter at a rate of one ton an hour or more, which fall within any of the following descriptions and in which the matter being heated does not contribute to the emission of grit and dust:— (*a*) Furnaces burning liquid matter, gas, or liquid matter and gas; (*b*) hand-fired sectional furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*c*) magazine type gravity-fed furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*d*) furnaces fitted with an underfeed stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of the plan area of the combustion chamber; (*e*) furnaces fitted with a chain grate stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*f*) furnaces fitted with a coking stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of area covered by the fire bars excluding the solid coking plate.	Any purpose except the incineration of refuse

(ii) The local authority may, on application, exempt a specific furnace installation providing that they are satisfied that the emissions will not be prejudicial to health or a nuisance. The local authority must give a written decision within eight weeks, and an aggrieved applicant may appeal within a further 28 days, to the Secretary of State.

An offence occurs if a furnace is exempt and is then used for a purpose other than one prescribed in the exemption.

When considering an application for approval of a proposed arrestor plant (or an application for exemption from the need to install an arrestor plant) the local authority will have regard to the probable grit and dust burden in the flue gases, and to the known efficiency of the proposed arrestor plant in order that they might compare the probable emission with any standard which might at the time be in force or which is under consideration. Industrialists and consultants would, in turn, be wise to remember that the Working Party on Grit and Dust Emissions proposed that their recommended standard levels of emission should be reviewed after three years in operation and that arrestor plant, unless very well maintained at all times, rarely operates at design efficiency after a few years in use.

C The Measurement of Grit and Dust Emissions

The legal provisions concerning the measurement of grit and dust emissions are to be found in Section 7 of the 1956 Act as amended by Section 5 of the 1968 Act. Regulations have been made which prescribe the procedure to be followed by a local authority which wishes grit and dust measurement to be made and by the industrialist on whom a notice has been served.

If a furnace (or range of furnaces served by one chimney) is used to burn:—

(i) pulverised fuel, or
(ii) any other solid matter at a rate of 100 lbs. or more per hour, or
(iii) any liquid or gaseous matter, at a rate equivalent to 1¼ million or more Btu/hr.

the local authority may serve a notice on the owner of the plant or occupier of the building, requiring grit and dust emissions to be measured.

If the plant burns:—

(i) less than one ton/hour of solid matter other than pulverised fuel, or
(ii) less than 28 million Btu/hour of liquid or gaseous matter.

the industrialist may serve a "counter notice" on the local authority, requiring the authority to carry out the measurements at its own expense, and the local authority is obliged to do so "from time to time" unless the counter notice is, in writing, withdrawn.

The Clean Air (Measurement of Grit and Dust) Regulations 1971 (Statutory Instrument 1971 No. 161), prescribe the administrative process to invoke the above provisions (a similar set of Regulations apply to Scotland):

(*a*) A local authority must give at least six weeks' notice in writing to an industrialist requiring:—
  (i) adaptations to be made to the chimney or flues, and
  (ii) the provision of the necessary equipment,

to enable measurements to be made in accordance with BS.3405:1961 "Simplified Methods for Measurement of Grit and Dust Emission from Chimneys". The British Standard describes five different types of equipment which can be used, and it is necessary to ensure that the type and position of sampling points is correct in relation to the type of equipment which will be used. The British Standard is currently under review.

(*b*) When the sampling points have been installed and the equipment provided (or it is known that the firm are engaging a consultant who possesses the equipment), the local authority must give at least 28 days' notice in writing, requiring the tests to be carried out in accordance with the methods details in pp.13–26 of the B.C.U.R.A. publication "Measurements of Solids in Flue Gases".
(*c*) Before making the measurement, the industrialist must give the local authority at least 48 hours' notice in writing, of the date and time of the commencement of the tests.
(*d*) The 1968 Act requires the industrialist to permit the local authority to be represented during the tests.
(*e*) The results of the test must be sent to the local authority within 14 days from the making of the measurements, and the reports shall include:—
  (i) the date(s) of the test(s);
  (ii) the number of furnaces discharging into the chimney on that date;
  (iii) the results of the measurements expressed in lbs./hour of grit and dust emitted, and in the case of solid fuel fired plant, the percentage of grit in the solids.

A notice may require the making of measurements from time to time or at stated intervals, but not at intervals of less than 3 months unless in the opinion of the local authority, the true level of emission cannot be determined without further measurement being made.

If an industrialist serves a "counter-notice" on the local authority, he need comply only with the (*a*)(i) above, i.e. make adaptations to the chimney to enable the measurements to be made, including the provision of scaffolding where necessary, and the provision of facilities such as electrical connections to enable the sampling equipment to be used. The local authority must provide the sampling equipment and conduct the test entirely at its own expense.

In various circulars and publications, the Ministry of Housing and Local Government, and the Working Party have emphasised that the measurement of grit and dust emissions is both time consuming and costly. It is unlikely, therefore, that local authorities will authorise the indiscriminate service of hundreds of notices on industrialists, but will concentrate in the first instance on those units which are thought to be giving rise to complaint of nuisance, or which they suspect are emitting solids grossly in excess of the proposed limits. In any event the majority of local authorities have still to arrange for their staff to be trained in the use of the sampling equipment.

D Fume Emission

Fumes are defined in the 1968 Act as "any airborne solid matter smaller than dust", and by this definition acid mist or liquid droplets are thereby excluded.

By virtue of the 1968 amendment to the definition of chimney in the 1956 Act, this now "includes structures and openings of any kind from or through which smoke, grit, dust or fumes may be emitted, and in particular includes flues".

There are, at the moment, no legal provisions which require the reduction or elimination of fume emissions, other than those specific fumes which are controlled by the Alkali Inspectors under the provision of the Alkali &c. Works Regulation Act 1906, as amended and extended by the Clean Air Acts 1956 and 1968, and by the Alkali Works Order 1966.

An important provision in the 1968 Act for possible future consideration is the power in Section 7 of the Secretary of State to apply to "fumes", certain provisions of the 1956 and the 1968 Acts, i.e. by Regulations the Secretary of State may apply the following provisions to fumes, as they apply to grit, dust or smoke:—

(*a*) **Clean Air Act 1956—Section 3**
Requirement that new furnaces shall be so far as practicable smokeless *"and fumeless"*.

(*b*) **Clean Air Act 1968—Section 2**
Emissions of grit, dust *"and fumes"* from furnaces (standard levels of emission).
Clean Air Act 1968—Section 3
Requirements to fit arrestment plant (*including fume arrestors*) to new furnaces.

Additionally, the Secretary of State has power to extend certain exemption provisions so that they relate to fume emissions or avoid the need to install fume arrestment plant.

4. MISCELLANEOUS PROVISIONS OF THE CLEAN AIR ACTS 1956 AND 1968

A. The Clean Air Act 1956 Section 4—Smoke Density Meters

This Section enables the Secretary of State to make Regulations requiring the installation, maintenance and use of smoke density meters and/or recorders obligatory.

No regulations have yet been made and it is thought that this is because, although smoke density meters can be fairly reliable, they are easily subjected to abuse and the results obtained can be varied almost at will by altering the calibration or failing to clean the viewing glasses, etc., which protect the light source and receiver.

Section 8—Information About Furnaces and Fuel Consumed

The local authority is empowered, by this section, to require an industrialist to supply information within 14 days as to the size of furnaces and fuel consumption but this information, in the vast majority of cases is provided willingly and voluntarily.

Section 18—Colliery Spoilbanks (including Waste Quarry-Shale)

Where a spoilbank is emitting smoke and fumes, or is likely to emit smoke and fumes, the following provisions apply:—

(*a*) **A spoilbank in use as at 5th July 1956, or commenced since that date**
The owner of the mine or quarry is required to employ all practicable means for preventing spontaneous combustion and for preventing emission of smoke and fumes.

(*b*) **A spoilbank the use of which had ceased by 5th July 1956**
If the spoilbank was no longer in use and its control had passed from the owner of the mine or quarry on or before the 5th July, 1956, the problem must be dealt with as a statutory nuisance under the provisions of Part III of the Public Health Act 1936 as amended.

Section 19—Railway Engines

Railway engines are subject to the dark smoke provisions of Section one of the 1956 Act, but are not subject to grit and dust emission provisions, nor to a Smoke Control Order.

Section 20—Vessels

Emission of smoke from vessels has been considered on a previous page.

Section 21—Exemption for Purposes of Investigation and Research

This section gives the local authority power to exempt a particular chimney, boiler or furnace, etc., from varying provisions of the Act when it is expedient to do so, to enable investigations or research relevant to air pollution to be carried out without rendering the applicant liable to proceedings.

If the local authority refuse exemption, the applicant has a right of appeal to the Secretary of State for the Environment.

Section 22—Crown Premises

In the event of excessive emissions of smoke, grit and dust from Crown premises, the local authority should notify the Minister responsible for the premises and he shall take appropriate action to prevent or minimise the emission.

Section 23—Clean Air Council

By means of this section the Secretary of State has established the Clean Air Council with one of his Junior Ministers as Chairman to review progress and obtain advice on air pollution matters. There is also a Clean Air Council for Scotland (Statutory Instrument 1957 No. 766).

Sections 25-29

These sections are mainly administrative and relate to research and publicity, improper disclosure of information by an officer, penalties for offences under the Act (Some of which have been increased by the Criminal Justice Act 1967), authorisation of works, and enforcement of the Act.

B. The Clean Air Act 1968

The only important provisions of this Act not previously mentioned are contained in section 11 and relate to registered processes under the Alkali Act. The section substantially repeals section 17 of the 1956 Act, and in particular removes the power of the local authority to apply to the Secretary of State for authority to institute proceedings in the event of excessive smoke, grit, dust, etc., from registered processes. It also brings within the control of the Alkali Acts "work subject or potentially subject to the Alkali Act".

Building Regulations—Prevention of Smoke Emission

The Building Regulations 1965, include a section, M2, relating to the prevention of emission of smoke. This supersedes the earlier byelaw on the subject. The full text of the section is:—

> "M2. In any building (other than a building erected under former control) there shall not be installed for the purposes of heating or cooking in that or any other building any appliance which discharges the products of combustion into the atmosphere, unless that appliance is designed to burn as fuel either gas, coke, or anthracite. Provided that nothing in this regulation shall prohibit the installation of:—
>
> (i) a furnace which complies with Section 3 of the Clean Air Act 1956; or
>
> (ii) any appliance of a class exempted conditionally or unconditionally from the provisions of Section 11 of the Clean Air Act 1956 (which relates to smoke control areas) by any order for the time being in force under subsection (4) of that section; or
>
> (iii) a solid fuel appliance with a bottom grate unsuitable for burning coke or anthracite but designed so as to be capable of use with an alternative bottom grate which is suitable for burning such fuel.

5. ROAD TRAFFIC POLLUTION LAW

Despite world-wide opinion that emissions from motor vehicle exhausts must be strictly controlled if the urban environment is to be improved, no effective legislation exists in the United Kingdom to deal with this problem, other than that of smoke pollution.

The Ministry of Transport (now part of the Department of the Environment) have made The Motor Vehicles (Construction and Use) Regulations 1969 (Statutory Instrument 1969 No. 321) in which clauses 24, 25, 26 relate to the construction of the vehicle to avoid emission, and clauses 84 and 85 to the actual use of the vehicle on the road.

Clause 24 requires every motor vehicle to be so constructed that no avoidable smoke or visible vapour is emitted.

Clause 25 refers to compression ignition (diesel) engines and requires excess fuel devices, for easy starting, to be so fitted that they cannot be operated by a person whilst he is being carried by the vehicle, unless (*a*) the device cannot be used after the engine has been started, or (*b*) does not cause any increase in smoke or visible vapour.

Clause 26 relates to those motor vehicles using solid fuel. Such vehicles must be fitted with efficient spark or grit arrestors and with a tray or shield to prevent ashes and cinders from falling onto the road.

Clause 84 requires that no person shall use or cause or permit to be used on a road any motor vehicle from which any smoke, visible vapour, grit, sparks, ashes, cinders or oily substance is emitted if the emission thereof causes or is likely to cause damage to any property or injury to any person who is actually at the time or who reasonably may be expected on the road, or is likely to cause danger to any such person as aforesaid.

Clause 85 requires the excess fuel device of a compression ignition (diesel) engine to be so maintained that it does not cause the engine to be supplied with excess fuel and requires that no person shall use the device, or cause or allow it to be used, to supply the engine with excess fuel whilst the vehicle is on a road.

6. THE ALKALI, ETC., WORKS REGULATION ACT

The Alkali, etc., Works Regulation Act, 1906, consolidates and extends previous similar Acts, the first of which was passed in 1863.

The Act includes a schedule of chemical processes and a list of noxious or offensive gases. Since 1906, this schedule and list have been extended by Statutory Orders made under the Public Health (Smoke Abatement) Act, 1926, and the Alkali, etc., Works Regulation (Scotland) Act, 1951. Such orders were made in 1928, 1935, 1939, 1950, 1958, 1961, 1963 and 1966.

The essence of the Act lies in the requirements that (1) scheduled processes must be registered annually; (2) as a prior condition in the case of a first registration the scheduled process must be provided to the satisfaction of the Chief Inspector with the "best practicable means" for preventing the escape of noxious or offensive gases to the atmosphere and for rendering such gases harmless and inoffensive; (3) the "best practicable means" must thereafter be maintained in good and efficient working order and must be operated continuously; (4) in the case of certain processes, upper limits are specified for the concentration of total acidity in effluent gases which may be discharged to the atmosphere.

Provision is made for the setting up and maintenance of an inspectorate to administer the Act, and regulations are included relating to the registration and inspection of works, general procedure, penalties, etc. The Chief Inspectors are required to make an Annual Report to be laid before Parliament, relating to the work of the inspectorate.

Under the Clean Air Act 1956, the provisions of the Alkali Act are extended to apply to smoke, dust and grit from premises controlled under the Act as they already do to noxious or offensive gases. Thus from 31 December 1956 virtually all forms of air pollution from processes registered under the Alkali Act are subject to control under that Act by the Alkali Inspectorate. Any other parts of a work are the responsibility of the local authority.

The Alkali, etc., Works Order

The first four Orders dealt mainly with processes in the heavy chemical and related industries where noxious or offensive gases are the potential offenders. In an Order which came into operation on 1 June 1958 the Minister of Housing and Local Government further extended the Alkali Act by adding to the list of scheduled processes a number which are responsible principally for emissions of smoke, grit and dust. Among these processes are a number for the production of iron and steel, iron or steel melting processes, and some copper and aluminium processes. Gas and coke works, electricity works, coal fired producer gas plant and lime kilns and certain ceramic kilns fired by coal or oil were also added to the list together with sulphate reduction and caustic soda plant and certain types of chemical incinerators. The Order also made the appropriate additions to the list of noxious or offensive gases.

The 1961 Order deals with emissions from the processing of uranium, beryllium, selenium and their compounds. The 1963 Order is much more comprehensive and was prepared largely to take into account the major changes which have taken place in recent years in the heavy chemical and allied industries. It also covers the burning of scrap cable to remove the insulation. This is necessary because of the increasing amount of cable covered with polyvinyl-chloride, which, on burning, gives rise to hydrochloric acid, chlorides and possibly phosgene. The Order begins the policy of descheduling certain of the 1958 Order smoke processes.

The 1966 Order is important, for in addition to making a few minor alterations to the lists of scheduled works and noxious or offensive gases, it revokes all the earlier seven Orders and consolidates them in the 1966 Order. Thus, all the Alkali Acts and Orders since 1863 are consolidated in the 1906 Act and the 1966 Order.

LIST OF REGISTRABLE WORKS

Under the Alkali &c. Works Regulation Act 1906, as extended by the Alkali &c. Works Order 1966, the works appearing in the following list must be registered annually.

All certificates expire on 1st April, whatever the date of issue.

A certificate of registration becomes invalid if it is not kept up to date when changes occur in the ownership of the works or the other registered particulars. Any such change must be notified to the Ministry and the certificate forwarded for alteration. This will be done free of charge.

It is an offence, carrying a penalty of up to £100, to operate any of these works without a current and correct certificate of registration.

Non-scheduled Works

1. Alkali Works

Works for:

(*a*) The manufacture of sulphate of soda or sulphate of potash, or

(*b*) The treatment of copper ores by common salt or other chlorides whereby any sulphate is formed,
in which muriatic acid gas is evolved.

2. Cement Works

Works in which aluminous deposits are treated for the purpose of making cement.

3. Smelting Works

Works in which sulphide ores, including regulus, are calcined or smelted.

Scheduled Works

These are the works mentioned in the first Schedule to the Act, as extended by the Alkali &c. Works Order 1966, as follows:

1. Sulphuric Acid Works

Works in which the manufacture of sulphuric acid is carried on by the lead chamber process, namely, the process by which sulphurous acid is converted into sulphuric acid by the agency of oxides of nitrogen and by the use of a lead chamber or by any other process involving the use of oxides of nitrogen.

2. Sulphuric Acid [*Class II*] *Works*

Works in which the manufacture of sulphuric acid is carried on by any process other than the lead chamber process, and works for the concentration or distillation of sulphuric acid.

3. Chemical Manure Works

Works in which the manufacture of chemical manure is carried on, and works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid and works for the granulating of chemical manures involving the evolution of any noxious or offensive gas.

4. Gas Liquor Works

Works [not being sulphate of ammonia works or muriate of ammonia works] in which sulphuretted hydrogen or any other noxious or offensive gas is evolved by the use of ammoniacal liquor in any manufacturing process, and works in which any such liquor is desulphurized by the application of heat in any process connected with the purification of gas.

5. Nitric Acid Works

Works in which the manufacture of nitric acid is carried on and works in which nitric acid is recovered from oxides of nitrogen and works where in the manufacture of any product any acid-forming oxide of nitrogen is evolved.

6. Sulphate of Ammonia Works, and Muriate of Ammonia Works

Works in which the manufacture of sulphate of ammonia or of muriate of ammonia is carried on.

7. Chlorine Works

Works in which chlorine is made or used in any manufacturing process.

8. Muriatic Acid Works

(*a*) Muriatic acid works, or works [not being alkali works as defined in the Act] where muriatic acid gas is evolved either during the preparation of liquid muriatic acid or for use in any manufacturing process or as the result of the use of chlorides in a chemical process;

(*b*) Tinplate flux works, works in which any residue or flux from tinplate works is calcined for the utilization of such residue or flux, and in which muriatic acid gas is evolved; and

(*c*) Salt works, works [not being works in which salt is produced by refining rock salt, otherwise than by the dissolution of rock salt at the place of deposit] in which extraction of salt from brine is carried on, and in which muriatic acid gas is evolved.

9. Sulphide Works

Works in which sulphuretted hydrogen is evolved by the decomposition of metallic sulphides, or in which sulphuretted hydrogen is used in the production of such sulphides, or any works in which sulphuretted hydrogen is evolved as part of a chemical process.

10. Alkali Waste Works

Works in which alkali waste or the drainage therefrom is subjected to any chemical process for the recovery of sulphur or for the utilization of any constituent of such waste or drainage.

11. Venetian Red Works

Works for the manufacture of Venetian red, crocus or polishing powder, by heating sulphate or some other salt of iron.

12. Lead Deposit Works
Works in which the sulphate of lead deposit from sulphuric acid chambers is dried or smelted.

13. Arsenic Works
Works for the preparation of arsenious acid, or where nitric acid or a nitrate is used in the manufacture of arsenic acid or an arseniate and works in which any volatile compound of arsenic is evolved in any manufacturing process and works in which arsenic is made.

14. Nitrate and Chloride of Iron Works
Works in which nitric acid or a nitrate is used in the manufacture of nitrate or chloride of iron.

15. Bisulphide of Carbon Works
Works for the manufacture, use or recovery of bisulphide of carbon.

16. Sulphocyanide Works
Works in which the manufacture of any sulphocyanide is carried on by the reaction of bisulphide of carbon upon ammonia or any of its compounds.

17. Picric Acid Works
Works in which nitric acid or a nitrate is used in the manufacture of picric acid.

18. Paraffin Oil Works
Works in which crude shale oil is refined and works in which crude petroleum is refined, and works in which any product of the refining of crude shale oil or crude petroleum is treated so as to cause the evolution of gases containing any sulphur compound, and works in which any such product is used in any subsequent chemical manufacturing process not being a process for the polymerisation or copolymerisation of such products for the manufacture of thermo-plastic materials.

19. Bisulphite Works
Works in which sulphurous acid is used in the manufacture of acid sulphites of the alkalis or alkaline earths and works for the manufacture of liquid sulphur dioxide or of sulphurous acid or of any sulphite and works [not being smelting works as defined in section 8, sub-section [1] of the Act of 1906 or other works defined elsewhere in this schedule] in which oxides of sulphur are evolved in any chemical manufacturing process.

20. Tar Works
Works where gas tar or coal tar is distilled or is heated in any manufacturing process and works in which creosote or any other product of the distillation of gas tar or coal tar is distilled or is heated in any manufacturing operation involving the evolution of any noxious or offensive gas.

21. Zinc Works
Works in which by the application of heat, zinc is extracted from the ore, or from any residue containing that metal, and works in which compounds of zinc are made by dry processes giving rise to fume.

22. Benzene Works
Works [not being tar works as already defined] in which any wash oil used for the scrubbing of coal gas is distilled, or in which any crude benzol is distilled.

23. Pyridine Works
Works in which pyridine or picolines are recovered or made.

24. Bromine Works
Works in which bromine is made or is used in any manufacturing operation.

25. Hydrofluoric Acid Works
Works in which hydrofluoric acid is evolved in the manufacture of liquid hydrofluoric acid or its compounds.

26. Cement Production Works
Works in which argillaceous and calcareous materials are used in the production of cement clinker and works in which cement clinker is ground or cement is packed.

27. Lead Works
Works [not being works for the recovery of lead from scrap by direct liquation] in which, by the application of heat, lead is extracted from any material containing lead or its compounds, and works in which compounds of lead are manufactured from metallic lead or its compounds by dry processes which give rise to dust or fume.

28. Fluorine Works
Works in which fluorine or its compounds with other halogens are made or used in any manufacturing process, and works for the manufacture of fluorides, borofluorides or silicofluorides.

29. Acid Sludge Works
Works in which acid sludge produced in the refining of coal tar, petroleum or other hydrocarbon derivatives is treated in such manner as to cause the evolution of any noxious or offensive gas.

30. Iron Works and Steel Works
Works in which:
(*a*) iron or ferro-alloys are produced in a blast furnace and in which raw materials for use in blast furnaces are handled or prepared; or
(*b*) iron ores for use in blast furnaces are calcined or sintered; or
(*c*) iron or steel is melted in Air or Rotary furnaces, fired by coal or oil, or in cupolas employing a heated air blast, or in electric arc furnaces; or
(*d*) steel is produced, melted or refined in Bessemer, Tropenas, open hearth or electric arc furnaces; or
(*e*) oxygen or air enriched with oxygen is used for the refining of iron or for the production, shaping or finishing of steels; or
(*f*) ferro-alloys are made by processes giving rise to fume.

31. Copper Works
Works in which:
(*a*) by the application of heat
  (i) copper is extracted from any ore or concentrate or from any material containing copper or its compounds; or
  (ii) molten copper is refined; or
  (iii) copper or copper alloy swarf is degreased; or
  (iv) copper alloys are recovered from scrap fabricated metal, swarf or residues by processes designed to reduce the zinc content; or
(*b*) copper or copper alloy is melted and cast in moulds the internal surfaces of which have been coated with grease-bound or oil-bound dressings. [But this paragraph does not apply to works in which the aggregate casting capacity does not exceed 10 tons per day.]

32. Aluminium Works
Works in which:
(*a*) aluminium swarf is degreased by the application of heat; or
(*b*) aluminium or aluminium alloys are recovered from aluminium or aluminium alloy scrap fabricated metal, swarf, skimmings, drosses or other residues by melting; or
(*c*) aluminium is recovered from slag; or

(*d*) molten aluminium or aluminium alloys are treated by any process involving the evolution of chlorine or its compounds.

33. Electricity Works

Works in which:

(*a*) solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of public transport; or

(*b*) boilers having an aggregate maximum continuous rating of not less than 450,000 lbs. of steam per hour and normally fired by solid or liquid fuel are used to produce steam for the generation of electricity for purposes other than those mentioned in the preceding paragraph.

34. Producer Gas Works

Works in which producer gas is made from coal and in which raw producer gas is transmitted or used.

35. Gas and Coke Works

Works [not being producer gas works] in which:

(*a*) coal, oil or mixtures of coal or oil with other carbonaceous materials or products of petroleum refining or natural gas or methane from coalmines or gas derived from fermentation of carbonaceous materials are handled or prepared for carbonisation or gasification or reforming and in which these materials are subsequently carbonised or gasified or reformed; or

(*b*) Water gas is produced or purified; or

(*c*) coke or semi-coke is produced and quenched, cut, crushed or graded; or

(*d*) gases derived from any process mentioned in paragraph (*a*) are subjected to purification processes.

36. Ceramic Works

Works in which:

(*a*) pottery products [including domestic earthenware and china sanitary ware, electrical porcelain, glazed tiles and teapots] are made in intermittent kilns fired by coal or oil; or

(*b*) heavy clay or refractory goods are fired by coal or oil in
  (i) intermittent kilns; or
  (ii) continuous grate-fired kilns, not being tunnel kilns; or
  (iii) any kiln in which a reducing atmosphere is essential; or

(*c*) salt glazing of any earthenware or clay material is carried on.

37. Lime Works

Works in which calcium carbonate or calcium-magnesium carbonate is burnt through the agency of coal or oil.

38. Sulphate Reduction Works

Works in which metallic sulphates are reduced to the corresponding sulphides by heating with carbonaceous matter.

39. Caustic Soda Works

Works in which:

(*a*) either concentrated solutions of caustic soda or fused caustic soda are produced in vessels heated by coal; or

(*b*) black liquor produced in the manufacture of paper is calcined in the recovery of caustic soda.

40. Chemical Incineration Works

Works for the destruction by burning of wastes produced in the course of organic chemical reactions which occur during the manufacture of materials for the fabrication of plastics and fibres, and works for the destruction by burning of chemical wastes containing combined chlorine, fluorine, nitrogen, phosphorus or sulphur.

41. Uranium Works

Works [not being works licensed under the Nuclear Installations [Licensing and Insurance] Act, 1959, and not being nuclear reactors or works involving the processing of irradiated fuel therefrom for the purpose of removing fission products] in which:

(*a*) any ore or concentrate or any material containing uranium or its compounds is treated for the production of uranium or its alloys or its compounds; or

(*b*) any volatile compounds of uranium are manufactured or used; or

(*c*) uranium or its compounds are manufactured, fashioned or fabricated by any dry process giving rise to dust or fume.

42. Beryllium Works

Works in which:

(*a*) any ore or concentrate or any material containing beryllium or its compounds is treated for the production of beryllium or its alloys or its compounds; or,

(*b*) any material containing beryllium or its alloys or its compounds is treated, processed or fabricated in any manner giving rise to dust or fume.

43. Selenium Works

Works in which:

(*a*) any ore or concentrate or any material containing selenium or its compounds is treated for the production of selenium or its alloys or its compounds; or

(*b*) any material containing selenium or its alloys or its compounds other than as colouring matter is treated, processed or fabricated in any manner giving rise to dust or fume.

44. Phosphorus Works

Works in which:

(*a*) phosphorus is made; or

(*b*) yellow phosphorus is used in any chemical or metallurgical process.

45. Ammonia Works

Works in which ammonia is:

(*a*) made; or

(*b*) used in the ammonia-soda process; or

(*c*) used in the manufacture of carbonate, nitrate or phosphate of ammonia or urea or nitriles.

46. Hydrogen Cyanide Works

Works in which hydrogen cyanide is made or is used in any chemical manufacturing process.

47. Acetylene Works

Works in which acetylene is made and used in any chemical manufacturing process.

48. Amines Works

Works in which:

(*a*) any methylamine or any ethylamine is made; or

(*b*) any methylamine or any ethylamine is used in any chemical process.

49. Calcium Carbide Works

Works in which calcium carbide is made.

50. Aldehyde Works

Works in which formaldehyde, acetaldehyde or acrolein or the methyl, ethyl or propyl derivate of acrolein are made.

51. Anhydride Works

Works in which acetic, maleic or phthalic anhydrides or the corresponding acids are made.

52. Chromium Works
Works in which any chrome ore or concentrate is treated for the production therefrom of chromium compounds or chromium metal is made by dry process giving rise to fume.

53. Magnesium Works
Works in which magnesium or any compound of magnesium is made by dry processes giving rise to fume.

54. Cadmium Works
Works in which metallic cadmium is recovered or cadmium alloys are made or any compound of cadmium is made by dry processes giving rise to fume.

55. Manganese Works
Works in which manganese or its alloys or any compound of manganese is made by dry processes giving rise to fume.

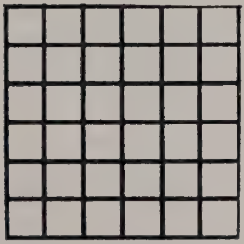
56. Metal Recovery Works
Works in which metal is recovered from scrap cable by burning the insulation.

LIST OF NOXIOUS OR OFFENSIVE GASES

The requirement of the 1906 Act is that the best practicable means shall be used to prevent the escape of noxious or offensive gases, whether directly or indirectly, into the atmosphere and for rendering such gases where discharged harmless and inoffensive. The expression "noxious or offensive gas" includes; the list of gases and fumes given in section 27[1] of the Act as extended by the 1966 Order; and as effectively extended by section 17[1] of the Clean Air Act, 1956, it also includes smoke, grit and dust. The list now includes:

Muriatic acid
Sulphuric acid and sulphuric anhydride
Sulphurous acid and sulphurous anhydride [except those arising solely from the combustion of coal]
Nitric acid and acid forming oxides of nitrogen
Chlorine and its acid compounds
Bromine and its acid compounds
Iodine and its acid compounds
Fluorine and its compounds
Arsenic and its compounds
Ammonia and its compounds
Cyanogen compounds
Pyridine
Bisulphide of carbon
Chloride of sulphur
Acetylene
Sulphuretted hydrogen
Volatile organic sulphur compounds
Fumes from benzene works
Fumes from cement works
Fumes from tar works
Fumes from paraffin oil works
Fumes containing copper, lead, antimony, arsenic, zinc, aluminium, iron, silicon, calcium, or their compounds
Fumes containing chlorine or its compounds
Smoke, grit and dust
Fumes containing uranium, beryllium, cadmium, selenium, sodium, potassium or their compounds
Carbon monoxide
Acetic anhydride and acetic acid
Aldehydes
Amines
Fumes containing chromium, magnesium, manganese, molybdenum, phosphorus, titanium, tungsten, vanadium or their compounds
Maleic anhydride, maleic acid and fumaric acid
Products containing hydrogen from the partial oxidation of hydrocarbons
Phthalic anhydride and phthalic acid
Picolines

THE BRITISH STANDARD RINGELMANN CHART AND THE BRITISH STANDARD MINIATURE SMOKE CHART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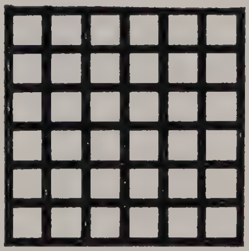
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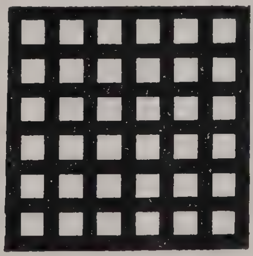
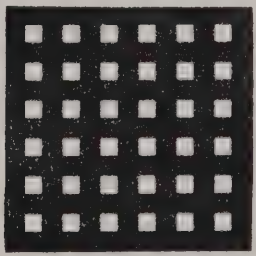

No. 3


No. 4

The method of visual assessment of smoke emission by comparison of the darkness of the smoke with standard shades of grey on a chart placed in a suitable position was devised by Professor Ringelmann of Paris towards the end of the 19th century. Professor Ringelmann obtained the shades of grey by cross-hatching in black on a white background so that a known percentage of the white was obscured.

The British Standard Ringelmann Chart (BS.2742C) see figure 1, is printed for the British Standard Institution so that the shades obtained in use are both consistent and near the average to those which users were accustomed when using the previously available commercially-printed Ringelmann Charts, including those issued by the U.S. Bureau of Mines.

The Chart consists of a cardboard sheet 581 mm × 127 mm on which are printed five 101 mm (4″) squares, four of which are cross-hatched by 20 horizontal and 20 vertical lines so that in use the cross-hatched black lines merge into the white background and produce for each shade, apparently, a uniform grey. For an average observer, the Chart must be placed more than 15 metres distant to produce the uniform shade.

The numbers of the shades—the Ringelmann numbers—range from 0 to 5; each shade increasing by comparison with the previous number by 20% obscuration so that

Ringelmann 1 = 20% obscuration
Ringelmann 2 = 40% obscuration
Ringelmann 3 = 60% obscuration
Ringelmann 4 = 80% obscuration

Ringelmann 5 (100% obscuration) is not reproduced on BS.2742C, and the black strip is included only for control during printing.

"Dark smoke" is smoke which is as dark as or darker than shade 2 on the Chart.

"Black Smoke" is smoke which is as dark as or darker than shade 4 on the Chart.

The Use of the Ringelmann Chart.

The use of the Ringelmann and Miniature Smoke Charts (see below) is described in BS.2742:1969.

The Ringelmann Chart should be firmly mounted onto a backing holder—aluminium is suitable—similar to that described in BS.2742. Protective coverings must *not* be applied to the Chart in use and nothing should impair the luminance of its working surface.

It should be used under daylight conditions and held in a vertical plane in line between the observer and the chimney top, at a distance of more than 15 metres to ensure the cross-hatched lines merge into shades of grey.

Where possible the general illumination of the sky should be uniform, but if the sun is shining or the sky bright on one side, the British Standard recommends that the bright source of illumination should be approximately at right angles to the line of vision and not in front of or behind the observer. Under hazy conditions observations should not be taken at extreme distance as there will be a tendency for the readings to be low. The angle of view of the Chart and smoke should be as low as possible; observations at a steep angle should be avoided.

The darkness of the smoke at the chimney terminal should be compared with the Chart; the Ringelmann number which most closely matches the darkness of the smoke, and the time and duration of the emission should be noted. In favourable conditions it is possible to estimate smoke darkness to the nearest quarter Ringelmann.

The Miniature Smoke Chart (BS.2742M)

Because of the situations in which the British Standard Ringelmann Chart cannot be used, the British Standards Institution has developed the Miniature Smoke Chart.

The Miniature Smoke Chart is a small card 129 mm × 69mm on which are printed shades of grey so that in use the shades correspond to the shades of the BS. Ringelmann Chart produced by the merging cross-hatching. The Standard indicates that, at this stage, the Miniature Smoke Chart is not intended for use as a substitute for the Ringelmann Chart; but in practice with an experienced observer the results obtained by use of either Chart are identical.

Since the Chart is slightly translucent, it should be backed with white opaque material or placed in a holder.

The Standard recommends that the Chart should be held at a distance of 1·5 metres from the eye in a holder on the end of a light rod; but also indicates that it can be held at arm's length—with some reservation on the accuracy of the readings obtained.

In other respects—lighting, angle of view, etc.—the Miniature Smoke Chart should be used similarly to the British Standard Ringelmann Chart.

The Microringelmann Chart.

This is a card 127 mm × 84 mm on which are printed an accurate photographic reduction of the cross-hatched Ringelmann shades 1 to 4, above and below a horizontal slot through which the chimney top is viewed. The lines almost merge to a shade when, in use, the Chart is held at arm's length.

The recommended method of use is different from that of the British Standard Charts in that with the Microringelmann the sun should be behind the observer.

The Chart is printed with a reflective surface and great care is required to obtain an accurate assessment of smoke colour. Some experienced observers consider that the use of the Microringelmann Chart should not now be recommended because of this difficulty.

The National Industrial Fuel Efficiency Service

N.I.F.E.S. provides a complete consulting engineering service covering all aspects of energy utilisation and associated pollution problems. Instrumented surveys are used to show by precise measurement how systems can be operated efficiently at minimum cost, and a regular service is provided to establish and maintain maximum efficiency. A full consulting service is provided for the design and specification of new buildings and ancillary services.

Comprehensive advice and assistance are available in connection with the implementation of the Clean Air Act and with other types of problem, including noise abatement and water pollution. Measurements of grit and dust emission as required by the Act can be undertaken. A complete design service is provided for Refuse Incineration.

British Standards relating to Air Pollution

B.S.

758 Small domestic hot-water supply boilers using solid fuel.
Part 1: 1955 Manually-controlled boilers. Amendments PD 2418, 1956; PD 2698, 1957; PD 4317, 1961; PD 4432, 1962.
Part 2: 1960 Thermostat-controlled boilers. Amendment PD 4139, 1961.

893 Method of testing dust extraction plant and the emission of solids from chimneys of electric power stations. 1940. Amendment PD 26, 1942.

1251 Open fireplace components.
Part 1: 1959 Firebacks for use with inset open fires.
Part 2: 1959 Fireplace surrounds and hearths.
Part 3: 1959 Adjustable chimney-throat restrictors (insertible).
Part 4: 1960 Lintels.

1252 Domestic solid fuel cookers with integral boilers. 1957. Amendments PD 3383, 1959; PD 4212, 1961; PD 4822, 1963.

1334 The use of thermal insulating materials for central heating and hot and cold water supply installations. 1969. (Metric).

1747 Methods for the measurement of air pollution. (Metric).
Part 1: 1961. Deposit Gauges.
Part 2: 1969. Determination of concentration of suspended matter.
Part 3: 1969. Determination of sulphur dioxide.
Part 4: 1969. The lead dioxide method.

1756 Methods for the sampling and analysis of flue gases. (Metric).
Part 1: 1963. Methods of sampling.
Part 2: 1963. Analysis by the Orsat apparatus. Amendments PD 5384, 1964; PD 5534, 1965; AMD 263, 1969.
Part 3: 1965. Analysis by the Haldane apparatus.
Part 4: 1965. Miscellaneous analyses. Amendment PD 5858, 1966.
Part 5: 1963. Semi-routine analyses.

1816 Heavy duty cooking ranges (solid fuel) 1957. Amendment PD 2814, 1957.

1846 Glossary of terms relating to solid fuel burning equipment.
Part 1: 1968. Domestic appliances.
Part 2: 1968. Industrial water heating and steam-raising installations.

2740 Simple smoke alarms and alarm metering devices, 1969. (Metric).

2741 Recommendations for the construction of simple smoke viewers. 1969. (Metric).

2742 Notes on the use of the Ringelmann and miniature smoke charts. 1969. (Metric).

C
2742 Ringelmann Chart. 1957.

M
2742 Miniature smoke chart. 1960.

2811 Smoke density indicators and recorders. 1969. (Metric).

2845 Coke-burning inset open fires without boiler and without convection.
Part 1: 1957. Dimensional and constructional requirements. Amendments PD 3517, 1959; PD 3981, 1960.
Part 2: 1959. Performance and constructional requirements. Amendments PD 3668, 1960; PD 3982, 1960; PD 4848, 1963.

2978 Measurements of smoke emission from industrial boilers.
Part 1: 1958. Medium capacity coal-fired water-tube boilers with travelling grates.
Part 2: 1961. Coal-fired shell boilers with various types of mechanical stokers.

3048 Code for the continuous sampling and automatic analysis of flue gases. Indicators and recorders. (Complementary to B.S. 1756, which covers manually operated instruments.)

3107 Small incinerators for the destruction of hospital dressings. 1959.

3128 Constructional and performance requirements for inset open fires with boiler and without convection. 1959. Amendments PD 3667, 1960; PD 3980, 1960; PD 4100, 1961; PD 4849, 1963; PD 5517, 1965.

3142 Manufactured solid smokeless fuels for household use.
Part 1: 1965. Cokes for domestic open fires.
Part 2: 1965. Cokes for domestic closed appliances.

3250 The thermal testing of domestic solid fuel burning appliances with convection.
Part 1: 1960. Flue loss method. Amendment PD 5140, 1964.
Part 2: 1961. Hood method. Amendment PD 4205, 1961.

3316 Large incinerators for the destruction of hospital waste. 1960.

3328 Domestic gas pokers and portable underbar ignition burners. 1961.

3376 Open fires with convection, with or without boiler. 1961.

3377 Back boilers for use with domestic solid fuel appliances. 1969. (Metric).

3378 Domestic heating stores using coke and other solid fuels. 1961.

3405 Simplified methods for measurement of grit and dust emission from chimneys. 1961. Amendment PD 4424, 1962.

3813 Incinerators for waste from trade and residential premises.
Part 1: 1964. Capacities between 50 lb./h. and 1000 lb./h.

3841 Method for the measurement of smoke from manufactured solid fuels for domestic open fires. 1965.

3929 Domestic solid fuel ignition pokers and portable undergrate ignition burners for use with commercial butane. 1965.

4076 Steel chimneys, 1966.

4433 Independent thermostatically controlled central heating boilers, with rated outputs up to 44kW. (Metric).
Part 1: 1969. Boilers with undergrate ash removal designed to burn solid smokeless fuels.
Part 2: 1969. Gravity feed boilers designed to burn small anthracite.

PD Recommendations for the design and testing of smoke
6434 reducing solid fuel burning domestic appliances. 1969.

AU The performance of diesel engines for road vehicles.
141 1967.

Codes of Practice

CP Installation of solid fuel stoves in caravans. 1966.
340

CP Open fires, heating stoves and cookers burning solid
403 fuel. 1952.

CP
403 101. Small boiler systems using solid fuel. 1952.

All the above Standards are obtainable direct from the British Standards Institution at British Standards House, 2 Park Street, London, W.1. (individual copies) or Newton House, 101-113, Pentonville Road, London, N.1. (bulk orders). British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The Cost of Air Pollution

The most recent general inquiry into the cost of air pollution in Britain was made by a sub-committee of the Committee on Air Pollution (the Beaver Committee), the findings of which were included as an appendix in the final report of the Committee in 1954. Members of the Committee have since stated that they consider the estimates to be too conservative. The total cost is now of the order of at least £350 million a year.

The main conclusions of the Report were:

(1) The direct costs of pollution to which figures can be put ("however hazardous") are as follows:

	£m. per annum
Laundry	25
Painting and decorating	30
Cleaning and depreciation of buildings other than houses	20
Corrosion of metals	25
Damage to textiles and other goods	52·5
	152·5

It is considered that these figures are underestimates, and as certain items have been omitted, it is concluded that the direct costs of air pollution are *of the order of at least* £150 *million a year.*

(2) The "loss of efficiency". The following figures are given as "a rough guess at possible orders of magnitude": £10m. a year loss to agriculture; £55m. a year loss of working efficiency in manufacturing industry; £60m. a year in other sections, including transport—altogether "the loss of efficiency resulting from pollution might be as great as the direct costs", but to avoid danger of over-estimates a figure of £100m. a year is suggested.

(3) The value of the fuel lost under the conditions which produce smoke is estimated to be £25m. to £50m. a year, but it is considered that this should not be included as one of the costs of pollution.

The total estimated cost is given as £250m. a year, equivalent to £10 per head in the black areas and £5 elsewhere throughout Great Britain, plus the value of the fuel lost.

Cost of Air Pollution Control

The amount of money spent by scheduled works in capital and working costs since the 1958 *Alkali and Works Order has been estimated from the returns submitted and is summarised in the table below. Working costs include depreciation and interest, operations, maintenance and repairs, overheads and miscellaneous.*

(*From the* 105*th Annual Report of the Chief Alkali Inspector,* 1968)

Works	*Capital*	*Research and Development*	*10-year Working Costs*	*Latest year's Working Costs*
1. Electricity	75,731,000	856,000	126,691,000	15,300,000
2. Cement	6,216,000	301,000	6,442,000	1,000,000
3. Petroleum	6,822,000	536,000	11,667,000	1,788,000
4. Gas	2,839,000	—	4,474,000	350,000
5. Coke Ovens	2,909,000	242,000	6,126,000	710,000
6. Lime	976,000	4,000	707,000	118,000
7. Ceramics	2,090,000	163,000	3,011,000	382,000
8. Iron and Steel...	26,430,000	1,235,000	93,351,000	10,364,000
9. Non-ferrous Metals	5,762,000	656,000	16,449,000	2,262,000
10. Chemical	20,527,000	952,000	55,516,000	6,782,000
TOTALS (£)	150,302,000	4,945,000	324,434,000	39,056,000

The History of Air Pollution in Great Britain

852 First records of the use of coal in England.

1228 Record of "Sacoles Lane" (sea-coals) in London.

1257 Eleanor, Queen of Henry III, left Nottingham for Tutbury on account of the smoke nuisance.

1273 Use of coal prohibited in London as being "prejudicial to health".

1306 Royal Proclamation prohibiting artificers from using sea-coal in their furnaces. Record of the execution of one offender.

1307 Commission of Inquiry appointed to "inquire of all such who burnt sea-coal in the city or parts adjoining, and to punish them for the first offence with great fines and ransoms, and upon the second offence to demolish their furnaces".

1563 Scarcity of wood fuel led to an Act prohibiting the export of wood. Consequent expansion of the coal trade.

1578 Queen Elizabeth I "findeth hersealfe greately greved and anoyed with the taste and smoke of the sea-cooles". Westminster brewers offered to burn wood because of her objection to coal smoke. Elizabeth, James I and Charles I all imposed export duties on coal.

1595 Thomas Owen brought Welsh coal and anthracite to London to demonstrate its smokelessness.

XVI century (Elizabeth's reign). Prohibition of coal in London whilst Parliament was sitting.

1603 Sir Hugh Platt's smokeless briquettes.

1648 Petition of Londoners to Parliament to prohibit the importation of coal from Newcastle on account of the injury they experienced.

1661 John Evelyn submitted his "Fumifugium, or the Smoake of London Dissipated", to Charles II.

1700 Publication of "Campania Foelix", with a "Discourse on the Fuel of London", by Timothy Nourse,—mentioned the "stink" of coal.

Circ. **1799** Benjamin Thompson's smokeless grates.

1801 Manchester Corporation Nuisance Committee on "Smoake".

1819 Committee appointed by Parliament to inquire how far persons using steam engines and furnaces could erect them in a manner less prejudicial to public health and comfort.

1843 A Select Committee recommended the introduction of a Bill dealing with nuisances from furnaces and steam engines.

1845 Another Select Committee reported that it was not desirable to extend the provisions of an Act beyond furnaces used for steam generation.

1845 Manchester cotton mill was observed to emit black smoke for 8 hrs. 52 mins. out of 9 hrs.

1845 Railway Clauses Consolidated Act requiring engines to consume their own smoke.

1847 The Town Improvement Clauses Act contained a section dealing with factory smoke.

1850 Manchester Smoke Inspector's Report—over 500 factory premises inspected—300 notices or cautions issued.

1853-6 Smoke Abatement Acts relating to the Metropolitan area.

1863 Alkali, etc. Works Regulation Act.

1866 The Sanitary Act empowered sanitary authorities to take action in cases of smoke nuisances.

1875 The Public Health Act containing a smoke abatement section on which legislation to the present day has been based.

1881 Formation of a Smoke Abatement Committee as a result of a movement started by the Kyrle Society and the Public Health Society.

1881 Smoke Abatement Exhibition at South Kensington organized by the Public Health and Kyrle Societies.

1882 Formation of the National Smoke Abatement Institution.

1882 Manchester Noxious Vapours Association held an exhibition.

1887 Failure of the Smoke Abatement (Metropolis) Bill in the House of Lords.

1891 The Public Health (London) Act.

1899 Formation of the Coal Smoke Abatement Society, led by Sir William Richmond, R.A., and Dr. H. A. Des Vœux (concerned mainly with London).

1903 Birmingham had four smoke inspectors.

1904 London County Council published a comprehensive report on the London smoke problem.

1905 The Government published a report on laws regarding smoke in other countries.

1905 Leeds appointed a full time smoke inspector. About this time the London Coal Smoke Abatement Society appointed smoke inspectors, but found little official support.

1906 The Alkali, etc. Works Regulation Act, which extended and consolidated previous similar Acts.

1909 Sheffield Smoke Abatement Exhibition, at which was set up the Smoke Abatement League of Great Britain (mainly for the provinces and centred later in Manchester and Glasgow).

1912 International Smoke Abatement Exhibition in London, organized by the Coal Smoke Abatement Society, leading to the formation of a Committee for the Investigation of Atmospheric Pollution.

1913 Smoke Abatement Bill introduced in the House of Commons by A. G. C. Harvey, M.P.

1914 Smoke Abatement Bill introduced in the House of Lords by Lord Newton. Withdrawn on the appointment of a Departmental Committee to investigate the problem.

1920 Committee re-formed after the war with Lord Newton as Chairman—they issued an Interim Report—dealing largely with domestic smoke.

1921 Publication of the Final Report of the Newton Committee.

1926 Public Health (Smoke Abatement) Act by which the 1875 and 1891 Acts were amended and extended.

1927 Establishment of first regional committees of local authorities.

1929 Amalgamation of the Coal Smoke Abatement Society and Smoke Abatement League of Great Britain to form the National Smoke Abatement Society. First publication of a journal (*Clean Air*) devoted to air pollution.

1935 First records of completely smokeless housing estates.

1936	Public Health Act, in which were included the provisions of the Smoke Abatement Act of 1926.
1946	Simon Report on Domestic Fuel Policy, recommending, *inter alia*, measures for domestic smoke prevention.
1946	First smokeless zone and prior approval legislation (Manchester Corporation Act).
1951	First smokeless zone established (in Coventry).
1952	Ridley Report on "Policy for the Use of Fuel and Power Resources", recommending, *inter alia*, measures for smoke prevention.
1952	London smog disaster, the most serious for many years, with a death roll of 4,000 (*q.v.*).
1953	Beaver Committee on Air Pollution set up by the Government and published an Interim Report.
1954	Final Report of the Beaver Committee.
1954	A Clean Air Bill introduced by Gerald Nabarro, M.P., and withdrawn (4 February 1955) on Government undertaking to introduce their own Bill.
1955	Whole of City of London declared a smokeless zone.
1956	Clean Air Act.
1958	National Smoke Abatement Society became incorporated under new name of National Society for Clean Air.
1959	International Diamond Jubilee Clean Air Conference and Exhibition (N.S.C.A.), London.
1962	Smog episode in London and other cities. Estimated death roll of 750 in Greater London.
1962	Holborn M.B. first local authority in country to reach its final target under Clean Air Act.
1964	Amendments to Clean Air Act in Housing Act, 1964, modifying smoke control area policy. Clean Air Act (Northern Ireland).
1966	First Congress of the new International Union of Air Pollution Prevention Associations (in London).
1966	Alkali, etc. Works Order revoked all earlier seven Orders and consolidated them, making a few minor alterations to the lists of scheduled works and noxious or offensive gases.
1968	Clean Air Act passed.
1969	Clean Air Act brought into operation.
1970	Second Congress of the International Union of Air Pollution Prevention Associations (in Washington).
1971	The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations and the Clean Air (Emission of Grit and Dust from Furnaces) Regulations.

The Clean Air Case

A Synopsis for the Guidance of Speakers, Writers, Teachers, etc.
A Chronological Table

1. Historical Background. Growth of the air pollution problem and efforts to abate it, from 852 to the present day. (*See History table.*)

2. Nature, Sources and Causes, Smoke: Due to incomplete combustion; consists of fine carbonaceous particles and tarry droplets. (For quantities produced, *see Table.*)

Gases: Sulphur dioxide the most harmful, especially when in association with smoke particles. Also carbon monoxide, and noxious gases and fumes from chemical processes. See the Society's Report on *Sulphur Dioxide as an Air Pollutant*.

Grit and dust: Mainly from industrial sources, e.g., pulverized coal and highdraught furnaces.

3. Extent and Behaviour of Pollution. Measurement of floating and deposited impurities, sulphur dioxide, and of light values. The Investigation under the Warren Spring Laboratory (*q.v.*).

4. Fog. Natural and smoke fogs, their formation and characteristics. The London, 1952, 1962, and other lethal smogs.

5. Effects. *Health:* Effects on respiratory system. Effects due to obstruction of natural light. Possible relationship with lung cancer. Psychological and social consequences of life in smoke-ridden environment. Effects of smog are the result of infrequent high concentration of pollution, whereas the insidious action of "normal" pollution takes place continuously.

Plant Life: Principal factors injurious to vegetation are: loss of sunlight, blocking of stomata by deposits, direct attack by chemicals, acidification of soil. Indirect effect on grazing animals through deterioration of herbage, or of poisoning in the case of fluoride pollution.

Materials: Corrosion or erosion of metals, stone, fabrics, leather, etc.

Visibility: Loss of visibility due to smoke haze and smog affecting air and surface transport.

Costs: See information on page 46.

6. Prevention. *Industrial Smoke:* Calls for correct equipment, maintenance and operation of plant. Value of mechanical stoking. Uses of oil, gas, electricity and smokeless solid fuel. Importance of training and certification of stokers. Instrumentation, smoke alarms, etc. Need for all-round fuel efficiency. *Dust and grit:* Use of arrestors of appropriate types: cyclones, wet washing, electrostatic precipitators. *Sulphur:* removal by coal washing, flue gas-washing and other possible means. Importance of high chimneys and emission velocity.

Domestic: By use of smokeless fuels—gas, electricity, oil or solid. Need for efficient appliances. Central and district heating, whole-house warming, off-peak electrical methods, etc. Smoke control areas, purpose and national programme.

Railways and Roads: Use of diesels and electricity for the former. Need for efficient combustion and good maintenance in road vehicles.

7. Policy, Law, etc. The present law—Clean Air Acts, 1956 and 1968, Public Health Act, 1936, local Acts, Road Traffic Act, 1930, Alkali, etc., Works Regulation Act, 1906, and Orders, etc. The Beaver Report and its proposals. Responsibilities of local authorities and central Government. Smokeless zones and smoke control areas. Work of the Warren Spring Laboratory. Alkali Inspectorate and other organizations. Educational and publicity work of the National Society for Clean Air.

(*See also the NSCA booklet "Notes on the background to Clean Air", 25p.*)

Let all enjoy the good clean air.

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DUST EXTRACTION EQUIPMENT TO INDUSTRY

Recent Books, Papers and Reports

A Selected List

General

Royal Commission on Environmental Pollution. Chairman: Sir Eric Ashby. First Report, 1971 p. 51, H.M.S.O. (45p).

The Protection of the Environment: the Fight Against Pollution, p. 29, H.M.S.O., 1970 (15p).

The Doomsday Book. Taylor, Gordon Rattray, p. 335, Thames and Hudson, 1970 (£2·10).

Eco-Crisis. Edited by Cecil E. Johnson, p. 182, John Wiley, New York/London, 1970 (£1·55).

Environmental Health Report 1969, p. 79, Association of Public Health Inspectors, 19 Grosvenor Place, London, S.W.1. (25p).

Annual Report of the Scientific Adviser, 1969, p. 96, Greater London Council Scientific Branch; Director-General's Department, Publication 7168-03224 (90p) postage extra.

Conservation: Man and Environment. Boote, R. E. Nat. Soc. for Clean Air. Proc. p. 34, Southport Conf. 1970 (Part I: £2).

Cleaning our Environment: the Chemical Basis for Action. A Report by the Sub-Committee on Environmental Improvement, Committee on Chemistry and Public Affairs, American Chemical Society, Washington, D.C., 1969 p. 249 ($2·75).

Approaching the Benign Environment. The Franklin Lectures in the Sciences and Humanities. Edited by Taylor Littleton, p. 121, University of Alabama Press, 1970 ($6).

Industrial

106th Annual Report on Alkali, etc. Works for 1969. Chief Inspectors, p. 81, H.M.S.O., 1970 (50p).

The Disposal of Refuse by Incineration. Higginson, A. E. Nat. Soc. for Clean Air, Proc. p. 21, Southport Conf. 1970 (Part I: £2).

The Clean Air Act: The Measurement of Grit and Dust Emissions. Short, W. Nat. Soc. for Clean Air. Proc. p. 13, Southport Conf. 1970 (Part I: £2).

Clean Air—The Balance Sheet: Industry's Viewpoint. Challis, E. J. Nat. Soc. for Clean Air. Proc. p. 58, Southport Conf. 1970 (Part I: £2).

Quantitative Analysis of Gaseous Pollutants. Ruch, Walter E., p. 241. Ann Arbor-Humphrey Science, 1970 (not yet priced in U.K.).

Economic Impact of Air Pollution Controls on Gray Iron Foundry Industry. U.S. Dept. of Health, Education and Welfare; Public Health Service, Environmental Health Service, National Air Pollution Control Administration, Raleigh, North Carolina. No. AP-74, p. 124, 1970 (65 cents).

Effects of Air Pollution

Public Health Implications of Radioactive Waste Releases. Straub, C. P., p. 61, World Health Organization, Geneva, 1970 (80p).

Pollution from Road Vehicles and Health. Lawther, P. J. and Commins, B. T. Nat. Soc. for Clean Air. Proc. p. 137, Southport Conf, 1970 (Part I: £2).

Air Pollution Injury to Vegetation. Hindawi, Ibrahim Joseph, p. 44, U.S. Dept. of Health, Education and Welfare, Public Health Service, Environmental Health Service, National Air Pollution Control Administration, Raleigh, North Carolina, 1970 ($1·25).

Road Vehicles

Recent Developments in the Control of Exhaust Emissions from Petrol Engines. Lindsay, R. and Thomas, A. Nat. Soc. for Clean Air. Proc. p. 118, Southport Conf, 1970. (Part I: £2).

The Development of the Electronically Controlled Petrol Injection System. Croft, B. H. Nov. 1970. The Institution of Mechanical Engineers, Automobile Division, 1 Birdcage Walk, Westminster, S.W.1.

Measurement and Research

Research into Environmental Pollution. Report of five WHO Scientific Groups p. 83, World Health Organization, Technical Report Series No. 406, Geneva 1968 (40p).

Guide to Research in Air Pollution: Projects Active in Calendar Year 1969. Compiled by Centre for Air Environment Studies, Pennsylvania State University. U.S. Dept. of Health, Education and Welfare, Public Health Service, Environmental Health Service, National Air Pollution Control Administration, Raleigh, North Carolina, April 1970 ($1·50).

Measurement of Air Pollution: Absorption of Sulphur Dioxide by Teflon Wool. Ward, A. B. Dept. of Trade and Industry, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts., 1970. SBN 900790 51 2.

The National Survey of Air Pollution. Report No. 1. Air Pollution in Urban Areas in the United Kingdom: Present Position and Recent National and Regional Trends. Craxford, S.R., Weatherley, M-L.P.M. and Gooriah, B. D. Dept. of Trade and Industry, Warren Spring Laboratory, 1970.

Fuel

Report of an Inquiry into the Safety of Natural Gas as a Fuel. Morton, Frank, p. 87, Ministry of Technology, H.M.S.O., 1970 (42½p).

Solid Fuel. Edwards, M. J. Nat. Soc. for Clean Air Conf., Southport, 1970. National Coal Board, Hobart House, Grosvenor Place, S.W.1.

Gas. Clegg, B. G. H. Nat. Soc. for Clean Air. Proc. p. 86, Southport Conf., 1970 (Part I: £2).

Electricity. Phillips, R. H. Nat. Soc. for Clean Air. Proc. p. 92, Southport Conf., 1970 (Part I: £2).

Oil. Pearce, A. W. Nat. Soc. for Clean Air. Proc. p. 104, Southport Conf., 1970 (Part I: £2).

Films and Filmstrips

Following is a list of films and filmstrips on air pollution and its prevention, fuel efficiency, etc. Application for the loan of the films should be made to the issuing organization, referred to in the list by its initials, the key to which is given at the end of the list. The films are available free unless otherwise stated. Two-three weeks advanced notice of hire should be given. The running time in minutes is shown. Unless otherwise indicated, the films are available in both 16 mm. and 35 mm. sizes, with sound.

The Society welcomes information on other films suitable for inclusion in future editions of the Year Book.

Films

GENERAL AND EDUCATIONAL

The First Mile Up. The experience of cities in North America making vigorous efforts to combat air pollution. Smoke prevention in Toronto. Particularly well illustrated. 16 mm. 28 mins. C.F.C. (hire fee £1·60).

And On the Eighth Day . . . Outstanding programme on the pollution of our environment, in four sections: Water; Air; Earth and Fire. A serious and challenging film. (A Thames T.V. Production) 60 mins. Colour. C.F.C. (hire fee £5·50.)

The Choice. The film's main themes are earth, fire and water. It concentrates on what is being done and what can be done, to preserve the environment. Science and technology have already provided most of the answers. Co-operation between industry and the community has already demonstrated that it can yield worthwhile results. Future success will depend on continuing research, continuing investment, and above all a wider and more vigorous co-operation. 29 mins. Colour. I.C.I.

Environment in the Balance. The film shows how geological, topographical and social developments in Britain have helped to shape our environment and discusses the problems of industrial expansion, population growth and pollution. Given the technological ability to safeguard the future, the issues depend on us all, as individuals. 16 mm. 30 mins. Colour. SM/BP (hire fee 25p).

The Shadow of Progress. This film won the Airlie Foundation Trophy at the Second International Clean Air Congress in Washington, 1970. It was considered the best general film about the environment. 16 mm. Colour. SM/BP (hire fee 25p).

DOMESTIC AND SMOKE CONTROL AREAS

Clean Air. Deals with air pollution and shows how modern methods of domestic heating meet the requirements of the Clean Air Act. 16 mm. 21 mins. Colour. SM/BP (hire fee 25p) and C.F.L.

French Architecture and Modern Heating. Modern solid fuel heating systems in a wide range of application to buildings all over France are featured in this N.C.B. Film Unit's English version of an attractive film made for the French coal industry. 27 mins. Colour. N.C.B.

People Like Us. An amusing film in which three typical houses are taken apart at the seams, and set to rights with solid fuel heating throughout. 15 mins. Colour. N.C.B.

Housewarming. What happens when a family decides to install solid fuel central heating. 17 mins. Colour. N.C.B.

Home and warm. Deals with the modernisation of an older type house and the installation of modern solid fuel central heating. 10 mins. Colour. N.C.B.

Welcome Home. Demonstrates the modern equipment available for burning solid smokeless fuels, and the range of these fuels available. The film also explains the Clean Air Act, how it works, and how solid fuel meets its requirements. 22 mins. Colour. N.C.B.

Group Heating in Paisley. District Heating claims great advantages over the more conventional domestic heating particularly in new development areas as is shown in this study of how a large complex of flats in the Scottish town of Paisley is heated by solid fuel from a single central boiler plant. 7 mins. Colour. N.C.B.

District Heating in Leicester. Shows how new residential developments are supplied with heat and hot water from their own central boiler plant. 10 mins. N.C.B.

Billingham Group Heating Scheme. A solid fuel group heating scheme serving mixed industrial, commercial and residential premises in a new town extension at Billingham, Co. Durham. 14 mins. Colour. N.C.B.

Gas in Modern Housing. Stresses the need to incorporate clean air principles in new house design. It shows in some detail the flexibility and labour-saving advantages of gas for space heating, domestic hot water, incineration and other purposes. 16 mm. 18 mins. Colour. G.C.

Project Halton Fields. Features a typical modern housing estate to show new developments in domestic oil-fired central heating on a district level and indicates to developers and architects the advantages to them and to potential house buyers of new systems and techniques. 16 mm. 20 mins. Colour. SM/BP (hire fee 25p).

HEALTH

It Takes Your Breath Away. A review of the causes of "dirty air" as produced by domestic and industrial smoke, traffic, etc. The effect on the lungs of living in this type of atmosphere is briefly shown and the film is of value to Public Health Workers as a means of ramming home the ill effects of a smoky atmosphere. 16 mm. 10 mins. B.M.A.

VEHICLE POLLUTION

You and Your Diesel. The importance of maintenance for diesel-engined lorries and tractors. 16 mm. 35 mins. Colour. SM/BP (hire fee 25p).

Horsepower and Hydrocarbons. The California Motor Vehicle Control Board explain the nature and extent of emission problems from the motor car. The alternatives to the petrol driven car are examined, as are methods of reducing levels of emission. The first film to approach all aspects of the problem fully. 16 mm. 22 mins. Colour. N.S.C.A.

FUEL, POWER AND INDUSTRIAL

No Tipping. Illustrates the "System Dusseldorf" approach to refuse disposal and shows the threat to clean air posed by traditional methods of refuse disposal. 16 mm. 14 mins. Colour. M.B.T.

Incineration—The Burning Question. Shows another method of refuse disposal and pinpoints the national problem of 17,000,000 tons of refuse needing to be disposed of annually. 30 mins. Colour. J.T.

Fluidised Coal Carbonisation and Hot Briquetting. There are not enough natural smokeless fuels. Coke is an excellent manufactured fuel but can be made only from certain coals. This film describes the work of the N.C.B. Coal Research Establishment at Stoke Orchard leading to the development of a new smokeless fuel for open fires. (For technically minded audiences.) 12 mins. N.C.B.

Homefire—Smokeless Fuel for the Open Fire. Based on small-sized smoky coal, a new smokeless fuel has been developed by the N.C.B. which burns in an open grate and gives a good flame. The manufacture of these smokeless briquettes is explained non-technically. 12 mins. Colour. N.C.B.

Coal: Our Wasting Asset. Deals with fuel efficiency, fuel conservation and the problem of smoke. Although over twelve years old, this film, which was a special issue of Mining Review, still has an important message about the proper use of solid fuel. 10 mins. N.C.B.

Saharan Venture. The story of the transportation of methane gas from the Sahara to help provide Britain with abundant supplies of clean fuel. 16 mm. 28 mins. Colour. G.C.

The Methane Story. A longer version of the above film, made for the benefit of specialists. It gives a chronological account of the entire scheme, with emphasis on the methods and techniques employed. 16 mm. 28 mins. Colour. G.C.

Power in Trust. Electricity plays an important role in all our lives. Through the eyes of a schoolboy the generation of electricity in a modern power station is explained. 15 mins. Colour. M.R., C.E.G.B.

Combustion and the Chain Grate Stoker. Shows chemical and physical principles of coal, combustion, and their application in chain grate stoker. 16 mm. 25 mins. B. & W.

This Age of Steam. Emphasizes the growth of world population, rising industrialization and improving standards of living, which result in a rapidly increasing demand for power, chiefly electrical power. 16 mm. 35 mins. Colour. B. & W.

Industrial Electric Heating. Describes the use of electricity for industrial heating processes. 30 mins. Colour. E.C.

Combustion. An instructional film for service engineers and boilerhouse staff. Includes an introduction to elementary chemistry and the reason for the production of smoke. A simple way of measuring the carbon dioxide content and the method of carrying out a complete gas analysis with an Orsat apparatus is explained as well as how draught can be measured and controlled in an industrial boilerhouse. 16 mm. 31 mins. Colour. H. & B. (hire fee £3).

Synchromatic. Begins with a descriptive sequence of the hopper type Synchromatic Underfed Stoker. The second part deals with the bunker type stoker with the transfer box which can be set at any angle to the axis of the boiler and at any inclination to the ground. The final part of the film is devoted to the Stoker fitted to a boiler under fire. 16 mm. 12 mins. Colour. H. & B. (hire fee £3).

Pulverized Fuel. Deals with principles of pulverized fuel use. 16 mm. 40 mins. B. & W.

The Properties of Coal. Shows how the properties of coal vary according to the areas where it is mined, and how these characteristics affect its behaviour during combustion. The film gives an explanation of swelling number and shows how various types of coal suit different types of stokers. 16 mm. 20 mins. Colour. H. & B. (hire fee £3).

Sea Born Treasure. Vividly highlights the background to the discovery of the first major new indigenous source of power since coal; the progress made in bringing it ashore and the isolation and hardships endured by the crews of the drilling rigs. Touches upon the connection this discovery of gas in the North Sea and the effect its distribution may be expected to have on the national economy and the citizen. 16 mm. 25 min. Colour. G.C.

Key to Issuing Organizations:

B.M.A.—British Medical Association Film Library, Tavistock Square, London, W.C.1.

B. & W.—Babcock & Wilcox Ltd., Babcock House, 209 Euston Road, London, N.W.1.

C.F.C.—Concord Films Council, Nacton, Ipswich, Suffolk.

E.C.—Electricity Council Marketing Department, Trafalgar Buildings, 1 Charing Cross, London, S.W.1.

G.C.—The Gas Council, 6-7 Great Chapel Street, London, W.1.

H. & B.—Hodgkinsons Bennis Ltd., Little Hulton, Worsley, Manchester.

I.C.I.—I.C.I. Film Library, Thames House North, Millbank, London, S.W.1

J.T.—John Thompson Ltd., Ettingshall, Wolverhampton, Staffs.

M.B.T.—Motherwell Bridge Tacol Ltd., Green Dragon House, 64-70 High Street, Croydon, Surrey.

M.R., C.E.G.B.—Public Relations, Midlands Region, C.E.G.B., Haslucks Green Road, Shirley, Solihull, Warwickshire.

N.C.B.—National Coal Board, Film Branch, 26-28, Dorset Square, London, N.W.1.

SM/BP—Shell-Mex and B.P. Film Library, 25 The Burroughs, Hendon, London, N.W.4.

Gas Flow. Research into the effects of various types of flue baffles and bridge heights in a Lancashire Boiler and an Economic Boiler. 16 mm. 7 mins. H. &. B. (hire fee £3).

Air Flow. A research film showing a series of experiments with the Hydraulic Flow Model applied to the Chain Grate Stoker. The Flow Model is used to demonstrate the conventional method of supplying air to a Chain Grate Stoker with a Dual Zone System. 16 mm. 9 mins. H. & B. (hire fee £3).

FILM STRIPS

The following film-strips are available on loan from the Society, with a hire charge of 17p to non-members.

*Denotes also available for purchase from the Society.

Air Pollution and You. Traces sources of air pollution and illustrates methods of control in 31 captioned frames. Colour, plus lecture notes. (Produced by Current Affairs Films of New York.)

Air Pollution. General survey of problems, methods of measurement, etc., prepared in consultation with the Association of Public Health Inspectors. Black and White, plus lecture notes. (Produced by Camera Talks Ltd.)

***Environment: Air Pollution, Parts 1 and 2**—(1) Local, Continental and Natural. 41 frames. (2) Industrial Pollution. 38 frames. Colour, plus lecture notes by Professor R. S. Scorer. (Produced by Diana Wyllie Ltd.) Sale price £3 each part.

***Chronic Bronchitis.** Section I:—Incidence and Causes. Section II:—Treatment and Management. Section III:—Public Health and the Prevention of Chronic Bronchitis. Colour. Lecture notes by Dr. J. L. Burn. (Produced by Diana Wyllie Ltd.) Sale price £2.

Small Heating Systems. Colour. (Produced by Union Head Visual Aids Ltd. for N.I.F.E.S.)

The Problem of Lung Cancer. Colour. (Produced by Camera Talks Ltd.)

Making the Modern Town (Smoke Abatement). A lecture by the Gas Council. Black and White. (Produced by Carlton Hill Film Studios.)

The Public Health Inspector. Colour. (Produced by Camera Talks Ltd.)

SMOKE CONTROL AREAS

Programmes and Progress

The following lists contain the names of local authorities in the "Black Areas" with (1) the target date for completion of their Smoke Control Programme (2) the final acreage when completed (3) acreage in operation on 31 December 1970, (4) total number of premises in operation on 31 December 1970.

The figures in most cases have been compiled directly from information obtained from the local authority concerned. In the few cases where such information was not received, figures were obtained from the records of the Department of the Environment.

Figures for orders which are suspended are not excluded, in most cases, as these are temporary measures and would give a misleading picture of the progress being made.

The figures in italics refer to acres and premises in smokeless zones established by local authorities before the Clean Air Acts and in areas where smoke control operates through tenancy agreements.

Bold type indicates completed programmes.
** Indicates figures at 1 April 1970, as no returns were received for position at 30 December, 1970.*

NORTHERN

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 31.12.70*	*4* *Premises (In Oper.) 31.12.70*
Tyneside and Wearside				
Gateshead C.B.	—	4,559	950	7,786
Newcastle C.B.	1975	11,401	5,094	29,127
South Shields C.B.	1980	4,877	488	4,835
Sunderland C.B.	—	13,391	1,001	9,053
Tynemouth C.B.	1987	5,000	1,142	4,303
Jarrow B.	1975	1,500	172	1,301
Wallsend B.	1990	3,544	979	3,885
Blaydon U.D.	—	—	291	1,096
Boldon U.D.	1976	7,344	4,701	3,234
*Felling U.D.	1976	—	545	3,115
Gosforth U.D.	1980/85	1,739	—	—
Hebburn U.D.	1974	1,563	1,260	5,331
Longbenton U.D.	—	6,786	538	970
Newburn U.D.	—	4,648	692	5,878
Ryton U.D.	—	—	—	—
Whickham U.D.	1977	6,213	952	2,061
Teesside				
Darlington C.B.	1984	6,775	537	3,557
Hartlepool C.B.	1976	11,280	2,941	13,357
Teesside C.B.	1974	—	9,836	38,457

YORKSHIRE

West Riding (North)				
Bradford C.B.	1974	25,504	15,614 *1,481*	64,580 *14,284*
Dewsbury C.B.	1975	6,720	3,775	8,025
Halifax C.B.	1977	14,081	3,480	19,804
Huddersfield C.B.	1980	14,147	5,160	22,466
Leeds C.B.	1975	40,613	17,156	68,120
Wakefield C.B.	1979	5,801	2,099	4,100
Batley B.	1979	4,457	1,101	5,283
Brighouse B.	1974	7,873	3,532	10,494
Castleford B.	—	4,394	56	507
Keighley B.	1973?	23,600	4,944	15,604
Morley B.	1977	9,529	6,000	8,200
Ossett B.	**1968**	**3,332**	**3,332**	**6,919**
Pontefract B.	1982	4,865	981	2,102
Pudsey B.	1975	5,323	2,736	5,016
Spendborough B.	1973/74	8,251	3,718	9,042
Aireborough U.D.	1971	6,856	5,045	10,700

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 31.12.70*	*4* *Premises (In Oper.) 31.12.70*
West Riding (North) (continued)				
Baildon U.D.	1972	2,830	2,740	5,250
Bingley U.D.	1972	11,418	6,993	7,528
Denholme U.D.	—	2,560	—	—
Elland U.D.	1974	5,951	3,907	3,331
Featherstone U.D.	—	4,425	—	—
Heckmondwike U.D.	1975	697	492	2,173
Horbury U.D.	1971	1,280	789	2,928
Horsforth U.D.	1973	2,706	1,505	4,389
Knottingley U.D.	1973	2,837	—	—
Mirfield U.D.	**1969**	**3,394**	**1,006**	**2,650**
Normanton U.D.	1985	3,061	56	132
Queensbury and Shelf U.D.	—	2,795	625	1,905
Rothwell U.D.	1974	10,695	3,525	5,765
Shipley U.D.	1971	2,184	1,933	10,550
Sowerby Bridge U.D.	1975	5,763	867	3,492
Stanley U.D.	—	—	499	1,657
West Riding (South)				
Barnsley C.B.	1980	7,819	1,954	3,911
Doncaster C.B.	1975	8,371	4,306	16,899
Rotherham C.B.	1975	8,000	3,027	13,049
Sheffield C.B.	1972	45,363	34,300	150,000
Conisborough U.D.	—	1,593	17	160
Cudworth U.D.	—	1,746	123	424
Darfield U.D.	—	—	—	—
Darton U.D.	1990	4,718	512	498
Dearne U.D.	1987	3,888	1,301	910
Dodworth U.D.	—	—	—	—
Hoyland Nether U.D.	1980	1,998	—	—
Mexborough U.D.	1975	1,452	248	386
Rawmarsh U.D.	—	—	—	—
Royston U.D.	1981	1,452	—	—
Swinton U.D.	—	1,718	813	2,000
Wath-upon-Dearne U.D.	—	2,265	898	1,836
Wombwell U.D.	—	3,838	—	—
Worsborough U.D.	—	3,420	—	—
Rotherham R.D.	—	28,859	—	—
East Riding				
Kingston-upon-Hull C.B.	1971	15,106	7,916	35,573

NORTH WESTERN

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 31.12.70*	*4* *Premises (In Oper.) 31.12.70*
South Lancashire and North-East Cheshire				
Bolton C.B.	1980	5,401	2,751	20,765
			86	*1,050*
Bury C.B.	1973	2,915	1,764	7,796
Manchester C.B.	1975	27,255	15,441	91,000
			523	*4,764*
Oldham C.B.	1978	6,392	2,876	11,329
Rochdale C.B.	—	9,556	5,974	23,649
			67	*337*
Salford C.B.	1972/73	5,202	3,423	47,150
			57	1,859
Stockport C.B.	1975	8,440	1,877	14,309
Wigan C.B.	1975	5,083	2,402	10,893
Altrincham B.	1976/77	3,519	1,203	4,781
Ashton-under-Lyne B.	1976	4,146	1,768	7,189
Dukinfield B.	—	1,725	1,457	4,154
*Eccles B.	1970	3,417	2,502	7,404
Farnworth B.	1978	1,504	612	2,796
Heywood B.	1972	8,303	3,413	10,877
Hyde B.	1973	4,170	2,911	7,624
Leigh B.	—	6,359	2,142	7,278
Middleton B.	1981	5,170	2,582	8,951

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 31.12.70*	*4* *Premises (In Oper.) 31.12.70*
South Lancashire and North-East Cheshire (continued)				
Mossley B.	—	3,661	54	589
Prestwich B.	1974	2,240	1,975	6,311
Radcliffe B.	—	4,915	1,737	3,695
Sale B.	1972	3,628	3,250	18,526
Stalybridge B.	1975	3,190	2,424	4,141
Stretford B.	1972	2,575	2,197	14,503
Swinton and Pendlebury B.	1975	3,363	1,019	5,379
Abram U.D.	—	1,984	—	—
Aspull U.D.	—	—	—	—
Atherton U.D.	1974	2,265	1,725	4,062
Audenshaw U.D.	1978	1,241	663	1,125
Blackrod U.D.	1973	2,392	996	330
Bredbury and Romily U.D.	—	4,295	522	2,042
Chadderton U.D.	**1969**	**3,014**	**3,014**	**11,994**
Cheadle and Gatley U.D.	**1968**	**5,299**	**5,299**	**21,822**
Crompton U.D.	—	2,865	1,548	3,200
Denton U.D.	**1969**	**2,589**	**2,589**	**15,391**
Droylsden U.D.	1974	1,245	943	5,973
Failsworth U.D.	1975	1,663	1,122	4,938
*Golborne U.D.	1975	5,765	202	394
Hindley U.D.	1979	2,162	225	1,518
Horwich U.D.	1979	3,254	302	760
*Ince-in-Makerfield U.D.	—	—	—	—
Irlam U.D.	1974/75	4,717	1,043	4,100
Kearsley U.D.	1980	1,720	380	1,068
Lees U.D.	1975	288	—	—
Little Lever U.D.	1976	808	—	—
Royton U.D.	1972	2,148	1,200	3,893
Tottington U.D.	1976/78	2,544	242	891
Tyldesley U.D.	—	5,174	870	1,564
Urmston U.D.	1972	3,469	2,334	9,815
Westhoughton U.D.	1980	5,554	1,145	2,046
Whitefield U.D.	**1968**	**3,380**	**3,380**	**7,226**
Worsley U.D.	1974/75	7,242	2,097	8,788
Central Lancashire				
Blackburn C.B.	1980	8,080	2,396	11,383
Burnley C.B.	1972	4,695	3,346	22,068
Preston C.B.	1975	6,357	2,479	19,679
			176	*1,918*
Accrington B.	1978	4,418	521	3,523
Colne B.	1974	1,200	523	4,043
Darwen B.	1980	—	961	2,451
Nelson B.	1973	2,087	685	6,577
Barrowford U.D.	—	1,387	—	—
Brierfield U.D.	1976	807	260	1,002
Church U.D.	1971	308	270	1,336
Clayton-le-Moors U.D.	1977	1,039	—	—
Fulwood U.D.	1980	3,164	469	865
Great Harwood U.D.	1976/77	2,686	320	620
Oswaldtwistle U.D.	1980	4,000	55	357
Padiham U.D.	1973	976	567	2,362
Rishton U.D.	1985	800	111	311
Merseyside				
Birkenhead C.B.	1974	6,716	3,166	14,003
Bootle C.B.	1978	3,330	1,502	8,183
Liverpool C.B.	—	27,819	14,762	81,912
St. Helens C.B.	1975	7,940	4,052	11,125
Wallasey C.B.	1974	5,961	5,349	27,660
Warrington C.B.	1973	4,629	3,782	18,531
Bebington B.	1978	6,000	3,000	13,000
Ellesmere Port B.	1977	4,000	1,956	9,137
Widnes B.	1978	5,000	2,775	9,894

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 31.12.70*	*4* *Premises (In Oper.) 31.12.70*
Merseyside (continued)				
Ashton-in-Makerfield U.D.	—	6,265	—	—
Haydock U.D.	—	—	—	—
Huyton-with-Roby U.D.	1988	3,054	1,157	5,863
Kirkby U.D.	1972	2,072	1,847	14,000
Litherland U.D.	—	1,187	401	688
Newton-le-Willows U.D.	1978	2,800	152	1,068
Prescot U.D.	1985	875	124	1,141
Runcorn U.D.	1975	8,000	1,220	4,536
MIDLANDS				
Derby, Nottingham and Chesterfield				
Derby C.B.	1979	18,000	5,277	17,853
Nottingham C.B.	1975?	18,364	6,850	22,892
			125	*2,000*
Chesterfield B.	1980	8,472	1,400	5,958
Ilkeston B.	1984	3,017	1,031	3,162
Mansfield B.	1980	7,009	2,229	4,419
Alfreton U.D.	—	4,957	209	210
Arnold U.D.	1978	4,505	504	2,132
Beeston and Stapleford U.D.	1974	6,468	4,759	15,247
Bolsover U.D.	—	4,326	86	230
Carlton U.D.	1982	4,018	420	3,496
Dronfield U.D.	1974	3,457	1,688	2,100
Eastwood U.D.	—	—	—	—
*Hucknall U.D.	—	4,029	538	1,053
Kirby-in-Ashfield U.D.	1981	5,831	93	834
Long Eaton U.D.	—	3,557	37	448
			57	*654*
Mansfield Woodhouse U.D.	1987	4,834	880	572
Staveley U.D.	1976	6,504	252	838
Sutton-in-Ashfield U.D.	—	10,507	1,838	3,932
West Bridgford U.D.	—	—	—	—
*Basford R.D.	—	—	—	—
Chesterfield R.D.	1976	17,828	7,623	9,574
North Midlands				
Leicester C.B.	1975	18,144	10,274	50,975
West Midlands				
Birmingham C.B.	1978	51,598	20,554	125,767
			203	*1,387*
Coventry C.B.	—	20,165	6,464	25,000
Dudley C.B.	1980	13,151	6,899	31,474
Solihull C.B.	1989	13,648	3,007	8,925
Walsall C.B.	1980	12,990	2,659	8,706
Warley C.B.	1989	9,471	1,781	14,500
West Bromwich C.B.	1987	11,704	2,705	14,751
Wolverhampton C.B.	1986	—	3,615	20,092
Halesowen B.	1975	5,237	3,045	7,956
Nuneaton B.	1978	11,767	3,161	5,195
Stourbridge B.	—	4,631	1,495	6,800
Sutton Coldfield B.	1979	13,691	1,825	6,982
Aldridge-Brownhills U.D.	1985	—	3,295	11,320
*Bedworth U.D.	—	—	2,187	3,714
Potteries				
Stoke-on-Trent C.B.	1980	22,949	8,100	19,900
Newcastle-under-Lyme B.	1984	8,861	3,237	10,346
Kidsgrove U.D.	1979/80	4,095	703	1,798
SOUTH WEST				
Bristol				
Bristol C.B.	1984	27,068	7,215	26,650

LONDON

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 31.12.70*	4 *Premises (In Oper.) 31.12.70*
Greater London Boroughs				
City of London	**1955**	**677**	**677**	**21,700**
Barking	1975	10,788	5,794	44,485
Barnet	1976	22,123	10,989	66,080
Bexley	1975	15,183	9,589	28,492
Brent	1976	10,928	6,955	67,064
Bromley	1977	37,583	7,327	38,757
Camden	**1968**	**5,364**	**5,364**	**87,303**
Croydon	1978	23,815	5,637	56,652
Ealing	1971	13,708	12,075	91,057
Enfield	—	20,061	16,347	74,250
Greenwich	1972	11,724	8,703	65,082
Hackney	**1967**	**4,814**	**4,814**	**90,507**
Hammersmith	**1967**	**3,950**	**3,950**	**72,559**
Haringey	**1968**	**7,491**	**7,491**	**84,683**
Harrow	1975/76	12,555	5,789	37,369
Havering	1976	29,650	11,659	49,415
Hillingdon	1978	27,258	14,001	38,264
Hounslow	1971	14,469	11,013	48,399
Islington	**1969**	**3,679**	**3,679**	**82,000**
Kensington and Chelsea (Royal)	1971	2,951	2,795	71,920
Kingston-upon-Thames (Royal)	1978	9,281	3,970	25,916
*Lambeth	1976	6,738	3,241	57,965
Lewisham	1972	8,579	8,182	84,500
Merton	1978	9,381	6,315	39,035
Newham	1976	8,986	2,029	23,395
Redbridge	1971	13,983	12,189	67,658
Richmond-upon-Thames	1972	13,470	12,917	62,201
Southwark	1976	6,981	4,437	63,981
Sutton	1975	10,732	4,071	32,265
Tower Hamlets	**1968**	**4,876**	**4,876**	**78,702**
Waltham Forest	1980	9,805	6,567	59,198
Wandsworth	1974	8,872	5,892	58,712
Westminster (City)	**1970**	**5,334**	**5,334**	**131,021**
Outer London				
Dartford	1976	4,292	2,735	9,310

Local Authorities Outside the Black Areas

Local Authorities outside the Black Areas who have Smoke Control Areas in operation, with total acreages and premises at 31.12.70.

	Acreage	*Premises*
Aylesbury B.	275	2,050
Basildon U.D.	4,128	19,207
Bedford B.	2,187	3,628
Belper R.D.	217	27
Blaby R.D.	870	1,483
*Blackburn R.D.	260	413
Brentwood U.D.	219	2,799
Burton-on-Trent C.B.	180	1,548
Cambridge B.	412	1,443
Canterbury C.B.	200	414
Chatham B.	3,200	7,647
Cheltenham B.	861	1,873
Cheshunt U.D.	975	6,930
Corby U.D.	1,296	8,000
Crawley U.D.	4,357	14,732
Crewe B.	937	5,576
Darlington R.D.	564	2,788
Easthampstead R.D.	180	1,086
Elstree R.D.	500	2,877
Exeter C.B.	5,428	11,671
Flaxton R.D.	**250**	**62**
Gillingham B.	8,314	10,922
*Glanford Brigg R.D.	1,526	1,860
Glossop B.	711	829
Grantham B.	1,496	3,933
*Gravesend B.	686	1,381
Hale U.D.	75	858
Harlow U.D.	**5,889**	**17,381**
Hazel Grove and Bramhall U.D.	1,262	5,980
Heanor U.D.	40	97
Hemel Hempstead B.	3,132	—
High Wycombe B.	2,753	10,433
King's Lynn B.	208	2,300
Kingswood U.D.	12	130
Lancaster B.	3,894	5,959
Leamington Spa B.	856	5,571

Local Authorities Outside the Black Areas—(continued)

	Acreage	*Premises*
Leek U.D.	96	350
Letchworth U.D.	1,103	5,190
Lincoln C.B.	1,491	2,320
Luton C.B.	3,113	15,306
*Marple U.D.	419	1,600
Meriden R.D.	2,453	21,515
New Windsor R.B.	415	1,082
*Northfleet U.D.	377	2,277
Norwich C.B.	104	1,002
Old Fletton U.D.	134	1,060
Oxford C.B.	2,036	7,795
*Peterborough B.	294	—
Potters Bar U.D.	901	2,911
Ramsbottom U.D.	959	1,132
Reading C.B.	2,387	10,163
Ripley U.D.	90	54
Rochester B.	3,183	12,553
Rugby B.	2,582	6,105
Runcorn R.D.	379	1,085
Saddleworth U.D.	227	400
Scunthorpe B.	2,995	9,527
Seaton Valley U.D.	1,960	2,457
Seisdon R.D.	1,052	159
Shrewsbury B.	379	2,369

	Average	*Premises*
Skelmersdale U.D.	2,647	1,405
Skipton U.D.	1,348	2,931
Slough B.	3,079	15,417
Southampton C.B.	1,648	7,780
South East		
Derbyshire R.D.	11	122
Southport C.B.	67	110
Staines U.D.	7,251	14,842
*Stanley (Co. Durham) U.D.	1,143	936
Swadlincote U.D.	553	97
Tamworth B.	1,114	2,820
Thurrock U.D.	4,636	11,765
Todmorden B.	728	5,316
Waltham Holy Cross U.D.	299	793
Warrington R.D.	2,267	1,442
Warwick B.	147	975
Watford B.	1,976	7,645
Wellington U.D.	197	984
Wetherby R.D.	**100**	**730**
Whiston R.D.	537	1,479
Whitley Bay B.	1,866	5,579
Wilmslow U.D.	293	2,587
*Winsford U.D.	608	4,417
Wortley R.D.	1,076	13,840

SCOTLAND

Total Acreage and Premises in Operation at 31.12.70.

	Acreage	*Premises*
*Alloa	272	1,131
Barrhead	599	3,834
Bearsden	1,321	3,770
*Bishopbriggs	572	1,394
*Clackmannan County	370	1,694
Clydebank	1,455	7,040
Coatbridge	**4,339**	**15,557**
Denny and Dunipace	113	515
Dumbarton Burgh	1,443	5,613
Dundee	5,188	31,598
***East Kilbride**	**6,003**	**18,893**
Edinburgh	7,086	26,339
Falkirk	3,388	8,589
*Fife County	852	3,242
Galashiels	953	2,450
Glasgow	22,580	157,709
Grangemouth	674	4,225
Hamilton	577	3,766
Kilmarnock	**77**	**300**
Lanark County	1,328	7,546
*Midlothian County	1,070	2,932
Milngavie	284	66
Motherwell	541	11,005
Paisley	4,314	20,107
Port Glasgow	1,210	5,407
Renfrew Burgh	1,433	4,628
Rutherglen...	639	4,403
Stirling County	4,162	8,656
*West Lothian	2,384	11

WALES

Total Acreage and Premises in Operation at 31.12.70.

*Connah's Quay U.D.	53	—
Mold U.D.	137	704
Newport C.B.	43	651
Wrexham R.D.	—	—
Pontypridd U.D.	—	—

(By arrangement only higher grades of Welsh Steam Coal is sold in the area)

NORTHERN IRELAND

Total Acreage and Premises in Operation at 31.12.70.

*Antrim R.D.	72	772
Belfast C.B.	609	5,785
Castlereagh R.D.	2,189	9,100
Craigavon U.D.	3,641	720
Hillsborough R.D.	507	1,161
Holywood U.D.	78	540
Lurgan B.C.	283	1,850
Newtownabbey U.D.	439	1,781
*Portadown B.C. ... ... (Nos. 1 and 2)	85	613

Erratum:—Clean Air Year Book 1970-71.

On page 75 of the above edition the acreage for the Borough of Harrow should have read 12,555 acres and not 21,555 as given in error.

Smoke Control Position in Regions of England
at 31 December 1970
(figures supplied by the Department of the Environment)

(1) Region	*(2)* No. of black areas acres covered by smoke control orders confirmed or awaiting decision	*(3)* Percentage* of total black area acreage in region covered	*(4)* No. of black area premises covered by smoke control orders confirmed or awaiting decision	*(5)* Percentage* of total black area premises in the region
Northern	39,993	31·9	161,692	29·2
Yorkshire and Humberside	186,856	49·6	625,146	53·5
East Midlands	65,320	24·3	193,865	37·9
Greater London	241,192	73·8	2,143,079	81·2
North Western	197,521	49·2	822,310	48·3
West Midlands	85,685	34·4	392,839	37·4
South Western	7,505	28·5	28,697	19·3
Total (black areas)	824,072	46·5	4,367,628	56·2
Outside black areas	152,149		492,857	
Grand Totals	976,221		4,860,485	

*The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (e.g.:—there may be some areas of open country).

Major Smog Disasters

The word "smog" was first used by the late Dr. H. A. Des Vœux, founder, president of the N.S.A.S. in 1905, to denote the combination of smoke and natural fog that in urban areas may have disastrous consequences. There are numerous cases of smog conditions resulting in a marked rise in mortality and morbidity from respiratory disorders and consequential cardiac failure. Among these incidents are the following:

London, 1873. Rise in bronchitis deaths, compared with the previous week, of 268.

London, 1880. Rise in bronchitis deaths, compared with the previous week, of 692.

London, 1891. Rise in bronchitis deaths, compared with the previous week, of 572.

Glasgow, 1909. Average number of deaths in the three weeks prior to the fog were 57 per week. During five weeks of fog or haze the deaths per week were: 138, 233, 171, 198 and 137.

Manchester and Salford, 1930-31. In December, with no fog, there were 137 respiratory disease deaths. In January there were nine days heavy fog and 592 deaths.

Meuse Valley, 1930. 60 deaths attributed to fog, the death rate rising to 10·5 times the normal. Many cattle had to be slaughtered.

London, 1948. Bronchitis deaths in week before fog, 73; in the week of fog, 148.

Donora, U.S.A., 1948. 18 deaths in a population of 14,000. 42 per cent of the population were estimated to have suffered from illness.

London, 1952. The fog developed on Friday, 5 December and continued until 8 December. Estimated total of 4,000 deaths in the Greater London area. In the Administrative County only deaths from bronchitis rose from 121 to 872, and from heart and circulatory diseases, from 318 to 801.

London, 1956. 1,000 additional deaths attributed to January fog in the Greater London area. (*B.M.J.*, 31 *March*, 1956.)

London, 1962. Fog in London and other areas, December 3-7, with similarities to the 1952 fog, but with 750 additional deaths as compared with 4,000.

Principal References

Mortality and Morbidity during the London Fog of December, 1952. Ministry of Health Public Health Report No. 95. (This report contains a section on "Previous Fog Incidents", with a statistical appendix for those in London.)

Les Problèmes de Pollution de l'Atmosphère, Batta, Firket and Leclerc, Liége, 1937.

Air Pollution in Donora, Pa. Public Health Bulletin, No. 306, Federal Security Agency, Public Health Service, Washington.

DIRECTORY OF ORGANIZATIONS

with Air Pollution Interests

GREAT BRITAIN

Alkali Inspectorate:

Chief Inspector, Department of the Environment, Whitehall, London, S.W.1 (01-930 4300 ext. 76).

Deputy Chief Inspectors, Department of the Environment, Whitehall, London, S.W.1 (01-930 4300 ext. 54 and 61).

Chief Inspector for Northern Ireland, M. D. Hinchliff, Government of Northern Ireland, Ministry of Health & Social Services, Lindsay House, Callendar Street, Belfast, BT1 5DU (Belfast 42751).

Chief Inspector for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY (031-226 5208).

Architects and Surveyors, Incorporated Association of, 29 Belgrave Square, London, S.W.1 (01-235 3755/7).

Architects, Royal Institute of British, 66 Portland Place, London, W1N 4AD (01-580 5533).

Arts, Royal Society of, 6-8 John Adam Street, London, WC2N 6EZ (01-839 2366).

BISRA—The Corporate Laboratories of the British Steel Corporation, 24 Buckingham Gate, London, S.W.1 (01-828 7931).

British Independent Steel Producers Association, 5 Cromwell Road, S.W.7 (01-581 0231).

British Industrial Measuring and Control Apparatus Manufacturers' Association, 23/24 Margaret Street, London, W1N 7LB (01-580 9336).

British Internal Combustion Engine Research Institute Ltd. 111/112 Buckingham Avenue, Slough, Bucks, SL1 4BH (Slough 27371).

British Ironfounders' Association, 30 St. James's Square, London, S.W.1 (01-930 6866 and 6436) and Fleming House, Renfrew Street, Glasgow, C.3 (041-332 0826/7).

British Medical Association, B.M.A. House, Tavistock Square, London, W.C.1H 9JP (01-387 4499).

British Oil & Gas Firing Equipment Manufacturers Association, Old Boundary House, London Road, Sunningdale, Berks. (Ascot 20294).

British Standards Institution, British Standards House, 2 Park Street, London, W1A 2BS (01-629 9000).

British Steel Corporation, P.O. Box 403, 33 Grosvenor Place, London S.W.1 (01-235 1212).

Building Centre, The, 26 Store Street, London, WC1E 7BT (01-636 5400).

Cast Iron Research Association, British, Alvechurch, Birmingham (Redditch 66414).

Central Electricity Generating Board, Sudbury House, 15 Newgate Street, London, E.C.1. (01-248 1202).

Centre for Environmental Studies, 5 Cambridge Terrace, Regent's Park, London, N.W.1 (01-486 3956).

Chemical Engineers, Institution of, 16 Belgrave Square, London, S.W.1 (01-235 3647).

Chemistry, Royal Institute of, 30 Russell Square, London WC1B 5DT (01-580 3482).

City and Guilds of London Institute, 76 Portland Place, London, W1N 4AA (01-580 3050).

Civic Trust, 17 Carlton House Terrace, London, S.W.1 (01-930 0914).

Civil Engineers, Institution of, Great George Street, London, S.W.1. (01-839 3611).

Clean Air Council, Department of the Environment, Whitehall, London, S.W.1 (01-930 4300 ext. 345).

Clean Air Council for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh, EH2 3JY (031-226 5208).

Clean Air, National Society for,

Central Offices: 134-136 North Street, Brighton, BN1 1RG (Brighton 26313).

Scottish Division: 78 Cochrane Street, Glasgow (041-221 9600 ext. 2538).

Northern Ireland Division: Belfast Corporation Health Department, 16 College Street, Belfast, BT1 6BX. (Belfast 41771).

North West Division: Health Centre, Salford, Lancs. (061-736 5891).

North East Division: Town Hall, Newcastle-upon-Tyne (28520).

Yorkshire Division: Health Dept., 12 Market Building, Vicar Lane, Leeds 1 (30211 ext. 29).

East Midlands Division: Health & Welfare Dept., Town Hall, Chesterfield (77232).

West Midlands Division: Public Health Inspector's Office, Municipal Buildings, Old Hill, Staffordshire (Cradley Heath 66891).

South East Division: Public Health Dept., 8 Easton Street, High Wycombe (High Wycombe 26100).

South West Division: St. Clement's House, Marsh Street, Bristol 1 (26241).

South Wales and Monmouthshire: 9 Lodge Drive, Baglan, Port Talbot (5231).

Coal Board, National, Hobart House, Grosvenor Place, London, S.W.1 (01-235 2020).

Coal Utilisation Council, 19 Rochester Row, London, S.W.1 (01-834 2339).

Coke Oven Managers' Association, Waveney House, Adwick Road, Mexborough, Yorks.

Coke Research Association, British, Chesterfield, Derbys. (Chesterfield 76821).

Combustion Engineering Association, Beaufort Chambers, 240B High Street, Slough, Bucks. (Slough 33211).

Confederation of British Industry, 21 Tothill Street, London, S.W.1 (01-930 6711).

Council for the Protection of Rural Wales, (Cymdeithas Diogelu Harddwych Cymru) Meifod, Montgomeryshire Meifod 383).

County Boroughs Association, Guildhall, Kingston-upon-Hull (Kingston-upon-Hull 36880).

County Councils Association, Eaton House, 66A Eaton Square, London, S.W.1 (01-235 5173).

County Councils in Scotland, Association of, 3 Forres Street, Edinburgh (031-225 1626/7).

Department of Trade & Industry, Millbank Tower, Millbank, S.W.1 (01-834 2255).

Derbyshire Clean Air Joint Consultative Committee, Town Clerk's Office, Town Hall, Chesterfield (0246 77232).

Domestic Solid Fuel Appliances Approval Scheme, 19 Rochester Row, London, S.W.1 (01-834 2339).

Electrical Association for Women, 25 Foubert's Place, London, W1V 2AL (01-437 5212/3).

Electrical Engineers, Institution of, Savoy Place, London, WC2R 0BL (01-240 1871).

Electrical Research Association, Cleeve Road, Leatherhead, Surrey, (Leatherhead 4151). Telex. 264045.

Electricity Council, 30 Millbank, London, S.W.1 (01-834 2333).

Environment, Department of, Whitehall, London, S.W.1 (01-930 4300). (See also Alkali Inspectorate).

Esso Petroleum Co. Ltd., Victoria Street, London, S.W.1 (01-834 6677).

Forest Products Research Laboratory (Ministry of Technology), Princes Risborough, Nr. Aylesbury, Bucks (084-44 3101).

Fuel, Institute of, 18 Devonshire Street, London, W1N 2AU (01-580 7124).

Fuel Technology, College of, 90 Talbot Road, Highgate, London, N.6 (01-340 6972).

Gas Council, The, 59 Bryanston Street, Marble Arch, London, W1A 2AZ (01-723 7030).

Gas Engineers, Institution of, 17 Grosvenor Crescent, London, S.W.1 (01-245 9811).

Gas Industries, Society of British, 17 Grosvenor Crescent, London, S.W.1 (01-245 9811).

Health and Social Security, Department of, Alexander Fleming House, Elephant and Castle, London, S.E.1 (01-407 5522).

Health Education Council, Middlesex House, Ealing Road, Wembley, Middlesex, HA0 1HH (01-998 2731).

Health, Royal Society of, 90 Buckingham Palace Road, London, S.W.1 (01-730 5134).

Heating and Ventilating Engineers, Institution of, 49 Cadogan Square, London, S.W.1 (01-235 7671/2/3).

Hospital Engineering, Institute of, 20 Landport Terrace, Southsea, Hampshire (0705 23186).

Housing Centre Trust, 13 Suffolk Street, London, S.W.1 (01-930 2881).

Institute for Conservation of Historic & Artistic Works, International, 608 Grand Buildings, Trafalgar Square, London, WC2N 5HN (01-839 5975).

Institute of Housing Managers, Victoria House, Southampton Row, London, W.C.1. (01-242 3267/8).

Institution of Corrosion Technology, The, 14 Belgrave Square, London, S.W.1. (01-245 9189).

Iron Council, Joint, 14 Pall Mall, London, S.W.1 (01-930 7171).

Ironfoundery Associations, Council of, 14 Pall Mall, London, S.W.1 (01-930 7171).

London Boroughs Association, Westminster City Hall, Victoria Street, London, S.W.1 (01-828 8070).
Low Temperature Coal Distillers' Association of Great Britain Ltd., P.O. Box No. 21, Chesterfield, Derbyshire (0246 82 2281/9).

Manchester and District Regional Clean Air Council, Town Hall, Manchester M60 2JS (061-236 3377 ext. 2551).
Mechanical Engineers, Institution of, 1 Birdcage Walk, London, S.W.1 (01-930 7476).
Medical Officers of Health, Society of, Tavistock House South, Tavistock Square, London, WC1H 9LD (01-387 3923).
Medical Officers of Health, The Society of, Tavistock House South, Tavistock Square, London W.C.1 (01-387 3923).
Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical College, Charterhouse Square, London, E.C.1 (01-252 1537).
Meteorological Office, London Road, Bracknell, Berkshire (0344 20242).
Meteorological Office, Weather Centres:
Forecasts, London: 01-836 4311.
Glasgow: 041-248 3451.
Manchester: 061-832 6701.
Newcastle: 0632 26453.
Southampton: 0703 28844.
Nottingham (Watnall): 060 75 3311.
Meteorological Society, Royal, 49 Cromwell Road, London, S.W.7 (01-589 0730).
Midlands Joint Advisory Council for Clean Air & Noise Control, Public Health Department, Ednam House, St. James's Road, Dudley, Worcs. (Dudley 55433 ext. 174).
Motor Industry Research Association, The, Lindley, Nr. Nuneaton, Warwickshire (Nuneaton 323664).
Municipal Corporations, Association of, 36 Old Queen Street, Westminster, London, S.W.1 (01-930 9861).
Municipal Engineers, Institution of, 25 Eccleston Square, London, S.W.1 (01-834 5082/3).

National Housing and Town Planning Council Incorporated, 11 Green Street, London, W.1 (01-629 7107/8).
National Industrial Fuel Efficiency Service, Abford House, 15 Wilton Road, London, S.W.1 (01-828 8241).
Northern Area: NIFES House, Sinderland Road, Broadheath, Altrincham, Cheshire (061-928 5791).
Midland Area: 26 Calthorpe Road, Edgbaston Birmingham, B15 1RP. (021-454 4471).
Southern Area: 54/58 Bartholomew Close, London, EC1A 7HD (01-606 5906).
National Trust for Places of Historical Interest or Natural Beauty, 42 Queen Anne's Gate, London, S.W.1 (01-930 0211).

Parliamentary and Scientific Committee, 7 Buckingham Gate, London, S.W.1 (01-834 2608).
Petroleum, Institute of, Atmospheric Pollution Committee, 61 New Cavendish Street, London, W.1 (01-636 1004).
Plant Engineers, Institution of, 138 Buckingham Palace Road, London, S.W.1 (01-730 0469).
Protection of Rural England, Council for the, 4 Hobart Place, London, S.W.1 (01-235 4771).
Protection of Ancient Buildings, Society for the, 55 Great Ormond Street, London, WC1N 3JA (01-405 2646).
Public Health and Hygiene, Royal Institute of, 28 Portland Place, London, W1N 4DE (01-580 2731/2).
Public Health Engineers, Institution of, 32 Eccleston Square, London, S.W.1 (01-834 3017).
Public Health Inspectors, Association of, 19 Grosvenor Place, London, S.W.1 (01-235 5158/9).

Road Transport Engineers, The Institute of, 1 Cromwell Place, Kensington, London, S.W.7 (01-589 3744).
Royal Institution of Great Britain, 21 Albemarle Street, London, W1X 4BS (01-493 0669 and 5716).
Rural District Council's Association, 25 Buckingham Gate, London, S.W.1 (01-828 7425/8).

Sanitary Association of Scotland, The Royal, 113 West Regent Street, Glasgow (041-248 7158).
Scientific Instrument Manufacturers' Assoc. of G.B., 20 Peel Street, London, W.8 (01-727 2614).
Sira Institute, South Hill, Chislehurst, Kent (01-467 2636).
Scottish Counties of Cities Association, City Chambers, Edinburgh (031-225 2424).
Scottish Development Department, 21 Hill Street, Edinburgh, EH2 3JY (031-226 5208).
Sheffield and District Clean Air Committee, Town Hall, Sheffield (0742 26444).
Shell-Mex & B.P. Ltd., Shell-Mex House, Strand, London, W.C.2 (01-836 1234).
Social Service, National Council of, 26 Bedford Square, London, WC1B 3HU (01-636 4066).
Solid Smokeless Fuels Federation, York House, Empire Way, Wembley, Middlesex (01-902 5405).
Standing Conference of Co-operating Bodies, Warren Spring Laboratory (Department of Trade and Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts. SG1 2BX (0438 3388).
Stationery Office, Her Majesty's, Atlantic House, Holborn Viaduct, London, E.C.1 (headquarters) (01-248 9876), and at Sovereign House, St. Georges Street, Norwich, NOR 76A (Norwich 22211).
Steel Castings Research and Trade Association, East Bank Road, Sheffield, S2 3PT (0742 28647).
Structural Insulation Association, 32 Queen Anne Street, London, W1M 0DP (01-580 7616).

Teesside Clean Air Committee, Town Clerk's Office, Municipal Buildings, Middlesbrough, Tees-side (0642 45984).
Town and Country Planning Association, 28 King Street, Covent Garden, London, WC2E 8JG (01-836 5006/7).
Town Planning Institute, 26 Portland Place, London, W1N 4BE (01-636 9107/8/9).

Urban District Council's Association, Palace Chambers, Bridge Street, London, S.W.1 (01-930 4868).

Warren Spring Laboratory, (Department of Trade and Industry) P.O. Box 20, Gunnels Wood Road, Stevenage Herts. SG1 2BX (0438 3388).
Warwickshire Clean Air Council, Council House, Coventry (Coventry 25555).
West Bromwich Clean Air Council, C.R. Creswell, West Bromwich Corporation, P.O. Box 40, Town Hall, Lombard Street West, West Bromwich.
West Lancashire and Cheshire Regional Smoke Abatement Committee, c/o Health Department, Hatton Garden, Liverpool L3 2AW, or 6 Brougham Terrace, Liverpool L6 1AE (051-263 5511 ext. 1).
West Riding Clean Air Advisory Council, Public Health Department, 25 East Parade, Leeds, 1 (0532 30661).
Women of Great Britain, National Council of, 36 Lower Sloane Street, London, S.W.1 (01-730 0619).
Women's Advisory Council on Solid Fuel, 19 Rochester Road, London, S.W.1 (01-834 4251).
Women's Gas Federation & Young Homemakers, Gaywood House, 29 Great Peter Street, London, S.W.1 (01-222 5351).

OVERSEAS

Argentine
Asociación Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires.
Australia
*Clean Air Society of Australasia, P.O. Box 31, George Street North, P.O., Sydney, New South Wales.
*Dept. of Public Health, Box 65, Rundle Street, Adelaide, South Australia.
*Dept. of Health, George Street, Brisbane, Queensland.
*Dept. of Health Services, 24 Campbell Street, Hobart, Tasmania.
*Dept. of Health, 316 Queen Street, Melbourne, Victoria.
*Dept. of Public Health, 57 Murray Street, Perth, Western Australia.
*Dept. of Public Health, N.S.W. Air Pollution Control Branch, 86-88 George Street, Sydney, N.S.W.
Austria
Austrian Society of Industrial Medicine, Sensengasse 2, A 1090 Vienna.
Belgium
*Centre Scientifique et Technique de la Construction, 5 Rue de la Violette, Brussels, 1.
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National Health Service of Denmark, 1 St. Kongensgade, 1264 Copenhagen K.

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Finnish Council for Air Conservation and Noise Abatement, Haartmaninkatu 1, 00290 Helsinki 29.

*Ministry of Internal Affairs, Aleksanterinkatu 3D, Helsinki.

France

Association pour la Prévention de la Pollution Atmosphérique. M. Yvan QUERET, 62, rue de Courcelles, 75—PARIS 8°

Association Technique de l'Industrie du Gaz en France, 62, rue de Courcelles, 75—PARIS 8°

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Institut für Grubensicherheit und Arbeitsschutz, Kirchgasse 11, Freiberg/Sa., DDR.

Institut für Technische Physik der Frauenhofer-Gesellschaft, Königstr. 70/74, 7000 Stuttgart-Degerloch. Director: Prof. Dr.-Ing. Gösele.

International Union for Conservation of Life (IUCL) Secretariate: Institut für Biologie und Lebensschutz, 6229 Schlangenbad-Georgenborn.

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Landesanstalt für Immissions- und Bodennutzungsschutz des Landes Nordrhein-Westfalen, Wallneyer Str. 6, 4300 Essen.

Rhein.-Westf. Technischer Überwachungs-Verein e.V., Steubenstr. 53, 4300 Essen.

Ruhrkohlen-Beratung GmbH, Frau-Bertha-Krupp-Str. 4, 4300 Essen.

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Verein Deutscher Ingenieure (VDI)—Kommission Reinhaltung der Luft—Graf-Recke-Str. 84, 4000 Düsseldorf, Secretary: J. Krämer.

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The Institute of Public Health, 1-39, Shiba Shirogane Daimachi, Minato-ku, Tokyo.

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Atmospheric Pollution Division, 14 Duinweg, The Hague.

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Council for Air Pollution, Leestraat 73, The Hague.

*Netherlands Association for Water, Soil and Air Pollution, Nienwe Achtergracht 100, Amsterdam.

Research Institute for Public Health Engineering T.N.O. (organisation for Health Research T.N.O.), Industrial Air Pollution Division, 97 Schoemakerstraat Delft.

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Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, 15213.

Bituminous Coal Research Inc., 35 Hochberg Road, Monroe, Pittsburgh 13, PA.

National Air Pollution Control Administration, 801 N. Randolph Street, Arlington, Virginia 22203.

Other U.S. Governmental Air Pollution Agencies and individual State Agencies are listed in an annual Directory published by the Air Pollution Control Association in co-operation with the U.S. Dept., of Health, Education and Welfare. A copy of this Directory is available at the library of the National Society for Clean Air.

U.S.S.R.

Institute of Communal Hygiene, Pogodinskaja 10, Moscow.

Medical Control Committee on Air Pollution, State Medical Commission, Moscow.

World Health Organization

Division of Environmental Sanitation, Palais des Nations, Geneva, Switzerland.

*Entry taken from last issue of "Clean Air Year Book" as no reply received from enquiry.

Estimates of Air Pollution in the United Kingdom

Table 1.—**Estimates of Pollution by Smoke and Oxides of Sulphur in Million Metric Tonnes from the Main Uses of Primary Forms of Energy in the United Kingdom in the Year 1969-1970**

(one metric tonne = 0·9842 long ton)

Estimates prepared by Albert Parker, C.B.E., D.Sc.

Figures for quantities of forms of energy were derived from the Digest of Energy Statistics 1969-1970 *of the Ministry of Technology*

Form of Energy and Class of Consumer	*Quantity of Energy*	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miners' coal	22·0	0·70
Railways	0·2	small
Industrial and miscellaneous, including collieries	27·8	0·08
	50·0	0·78
Sulphur oxides		
Coal		
Domestic, including miners' coal	22·0	0·56
Electricity power stations	77·1	2·20
Railways	0·2	small
Collieries	2·0	0·06
Industrial and miscellaneous	25·8	0·74
Coke ovens	25·7	0·08
Gas supply industry	7·0	0·05
Low temperature carbonization plants	2·4	small
Manufactured fuel plants	1·4	small
	163·6	3·69
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels	6·1	0·13
Industrial and miscellaneous	5·6	0·13
	11·7	0·26
Oil		
Domestic	2·7	0·01
Industrial and commercial	48·0	2·20
Gas supply industry	5·6	small
Road Transport	18·3	0·06
Railways	1·1	0·01
Marine craft (inland)	1·1	0·03
	76·8	2·31
Overall total		6·26
Hydro-electricity (coal equivalent)	2·0	
Nuclear-electricity (coal equivalent)	10·7	
Natural gas (coal equivalent)	8·4	
Total coal equivalent, including oil at 1 tonne = 1·7 tonnes of coal and including petroleum gases	322·7	

The amount of 48·0 million tonnes of oil used in 1969-1970 for industrial and commercial purposes is equivalent in heating value to about 81 million tonnes of coal, which if used for the same purposes would have produced about 0·23 million tonnes of smoke and 2·3 million tonnes of oxides of sulphur. The total amount of 6·26 million tonnes of oxides of sulphur is 1·94 per cent of the total coal equivalent of 322·7 million tonnes; the total amount of oxides of sulphur in 1968 was 2·00 per cent of the total coal equivalent.

Grit and Dust

In the absence of numerous measurements of the discharges of grit and dust from each of the various uses of solid fuels it is possible to make only rough estimates of the total quantity discharged into the air of the United Kingdom. My estimate is that in the year 1969-1970 the total amount was in the region of 0·55 million tonnes with somewhat more than one half from electricity power stations, one-third from the industrial uses of coal and coke and one-sixth from domestic fires. In addition there are discharges of considerable quantities of grit and dust from various industrial processes, including cement works and iron and steel works for example. The total quantity discharged from these various special processes in the year 1969-1970 was probably in the region of 0·5 million tonnes.

Table 2.—**Estimates of Pollutants from Road Vehicles in the United Kingdom in the Year 1969-1970 in Million Tonnes**

Consumption of Motor Spirit	13·45 million tonnes
Consumption of Derv Fuel	4·87 million tonnes

Pollutant	*Petrol Engines*	*Diesel Engines*
Carbon monoxide	6·3	0·10
Hydrocarbons	0·32	0·020
Aldehydes	0·01	0·003
Oxides of nitrogen	0·22	0·06
Oxides of sulphur	0·025	0·04

The estimated quantity of carbon monoxide discharged into the air from the other industrial and domestic uses of all fuels in the year 1969-1970 is about 10 million tonnes including about 4 million tonnes from domestic heating appliances. These discharges are above ground level whereas the discharges from road vehicles are at ground level.

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Legislation

Acts and Memoranda

Clean Air Act, 1956. The Statute governing smoke, containing sections on dark smoke, smoke from furnaces, grit and dust from furnaces, smoke control areas, smoke nuisances, special cases, clean air council and miscellaneous provisions. (H.M.S.O., 1956) 4 & 5 Eliz. 2 Ch. 52. 10p

Clean Air Act, 1956. Memorandum on Smoke Control Areas. (H.M.S.O., 1956) 6p

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions. (H.M.S.O., 1956) 3p

Amendment to Model Byelaws. Series IV Buildings (1953) Edition. (H.M.S.O., 1956) 1p

Thermal Insulation (Industrial Buildings) Act, 1957. (5 & 6 Eliz. 2 Ch. 40). (H.M.S.O., 1957) 3p

Clean Air Act, 1956. Memorandum on Industrial Provisions (H.M.S.O., 1958) 5p

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions (Scotland). (H.M.S.O., 1959) 5p

Housing Act, 1964. (H.M.S.O.). 43p

Clean Air Act (Northern Ireland) 1964. Memorandum on Smoke Control Areas (H.M.S.O., 1965) 11p

West Riding County Council (General Powers) Act, 1964. (H.M.S.O.) 15p

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Chimney Heights. Second edition of the 1956 Clean Air Act Memorandum (H.M.S.O., 1967) 10p

Chimney Heights Charts. The Appendices to the Clean Air Act publication "Chimney Heights" printed on permatrace. (H.M.S.O., 1967) 70p

Report of the Working Party on Grit and Dust Emission. (M.H.L.G. Memorandum). (H.M.S.O.) 15p

Clean Air Act, 1968. (H.M.S.O., 1968). Eliz. 2 Ch. 62. 10p

Regulations (Statutory Instruments)

Clean Air: The Smoke Control Areas (Authorized Fuels) Regulations, 1956. Statutory Instruments, 1956 No. 2023. (H.M.S.O., 1956) 1p

Clean Air Council Order, 1957. Statutory Instruments No. 766, 1957. (H.M.S.O.) 1p

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The Smoke Control Areas (Authorized Fuels) (Scotland) Regulations, 1966. S.I. No. 714 (S. 45). (H.M.S.O.) 1p

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The Smoke Control Areas (Exempted Fireplaces) Order, 1969. S.I. No. 164. (H.M.S.O.) 3p

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The Clean Air Act, 1968 (Commencement No. 2) Order 1969, Made 22 July 1969. S.I. No. 995 (C. 24) (H.M.S.O.) 2p

The Clean Air (Emission of Dark Smoke) (Exemption) Regulations, 1969. S.I. No. 1263. (H.M.S.O.) 4p

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Hinchliff, D.	1·50
Hood, N. R. S.	1·50
Jenkins, Major W.	1·50
Lynas, K. H.	1·50
Magee, J. L.	1·50
McAlery, Miss I. M. E.	1·50
Millar, J.	1·50
Muske, W. J.	1·05
O'Brien, W. E. C....	1·50
Porter, Colonel H. J.	2·10
Reynolds, A.	1·50

NORTH-WEST DIVISION

	£—p
Sustaining Members	
Mather & Platt Ltd.	100·00
Northern Gas Board	100·00
North-Western Gas Board ...	200·00
Shell Chemicals U.K. Ltd. ...	100·00
Simon Carves Ltd	200·00
Local Authority Members	
Abram U.D.C.	8·00
Accrington Cpn.	10·00
Altrincham Cpn.	10·00
Ashton-in-Makerfield U.D.C. ...	10·00
Ashton-under-Lyne Cpn. ...	10·00
Atherton U.D.C.	8·00
Audenshaw U.D.C.	8·00
Bacup Cpn.	8·00
Barrow-in-Furness Cpn.	13·00
Bebington Cpn.	13·00
Birkenhead Cpn.	2·10
Blackburn Cpn.	32·00
Blackpool Cpn.	32·00
Bolton Cpn.	32·00
Bootle Cpn.	12·60
Bredbury & Romiley U.D.C. ...	10·00
Brierfield U.D.C.	8.00
Bucklow R.D.C.	8·00
Burnley Cpn.	19·00
Burnley R.D.C.	8·00
Bury Cpn.	13·00
Buxton Cpn.	8·00
Chadderton U.D.C.	10·00
Cheadle & Gatley U.D.C. ...	13·00
Cheshire C.C.	60·00
Chester R.D.C.	10·00
Chorley Cpn.	10·00
Church U.D.C.	8·00
Clitheroe Cpn	3·15
Colne Cpn	8·00
Connah's Quay U.D.C.	8·00
Crewe Cpn.	13·00
Crompton U.D.C.	8·00
Crosby Cpn.	3·15
Cumberland C.C.	5·00
Darwen Cpn.	10·00
Denton U.D.C.	10·00
Droylsden U.D.C.	10·00
Dukinfield Cpn.	8·00
Eccles Cpn.	10·00
Ellesmere Port Cpn.	13·00
Failsworth U.D.C.	8·00
Farnworth Cpn.	10·00
Fleetwood Cpn.	10·00
Flint Cpn.	8·00
Fulwood U.D.C.	8·00
Glossop Cpn.	8·00
Golborne U.D.C.	10·00
Great Harwood U.D.C.	8·00
Hale U.D.C.	8·00
Haslingden Cpn.	8·00
Haydock U.D.C.	8·00
Hazel Grove & Bramhill U.D.C....	10·00
Heywood Cpn.	10·00
Hindley U.D.C.	8·00
Horwich U.D.C.	8·00
Hoylake U.D.C.	5·25
Huyton with Roby U.D.C. ...	13·00
Hyde Cpn.	10·00
Ince in Makerfield U.D.C. ...	8·00
Irlam U.D.C.	8·00
Kearsley U.D.C.	8·00
Kirby U.D.C.	13·00
Lancashire C.C.	60·00
Lancaster Cpn.	10·00
Lees U.D.C.	8·00
Leigh Cpn....	10·00
Leyland U.D.C.	8·00
Littleborough U.D.C.	8·00
Liverpool Cpn.	60·00
Longdendale U.D.C.	8·00
Macclesfield Cpn.	10·00
Manchester Cpn.	60·00
Marple U.D.C.	8·00
Matlock U.D.C.	8·00
Middleton Cpn.	13·00
Middlewick U.D.C.	8·00
Morecambe & Meysham Cpn. ...	10·00
Nantwich U.D.C.	8·00
Nelson Cpn.	10·00
Newton le Willows U.D.C. ...	8·00
Northwich R.D.C.	10·00
Northwich U.D.C.	8·00
Oldham Cpn.	26·25
Ormskirk U.D.C.	10·00
Padiham U.D.C.	8·00
Preston Cpn.	32·00
Preston R.D.C.	13·00
Prestwich Cpn.	10·00
Radcliffe Cpn.	10·00
Ramsbottom U.D.C.	8·00
Rawtenstall Cpn.	8·00
Rhyl U.D.C.	8·00
Riston U.D.C.	2·10
Rochdale Cpn.	19·00
Royton U.D.C.	8·00
Runcorn R.D.C.	10·00
Runcorn U.D.C.	10·00
St. Helens Cpn.	32·00
Sale Cpn.	13·00
Salford Cpn.	32·00
Skelmersdale & Holland U.D.C.	8·00
Southport Cpn	1·05
Stalybridge Cpn.	8·00

	£—p
Standish with Langtree U.D.C. ...	8·00
Stockport Cpn.	32·00
Stretford Cpn.	8·00
Swinton & Pendlebury Cpn. ...	10·00
Thornton Clevelys U.D.C. ...	5·25
Tintwistle R.D.C.	2·10
Tyldesley U.D.C.	8·00
Urmston U.D.C.	10·00
Wallasley Cpn.	32·00
Warrington Cpn.	13·00
Warrington R.D.C.	5·25
West Lancashire R.D.C.	1·05
Whiston R.D.C.	13·00
Whitefield U.D.C.	8·00
Whitworth U.D.C.	8·00
Widnes Cpn.	13·00
Wigan Cpn.	19·00
Wilmslow U.D.C....	10·00
Winsford U.D.C.	8·00
Workington Cpn.	8·00
Worsley U.D.C.	10·00
Wrexham Cpn.	10·00
Wrexham R.D.C.	10·00

Corporate Members

Ashton Bros. & Co. Ltd. ...	2·10
Beattle Ltd. E. & F.	1·05
Bibby & Sons	18·00
British Insulated Callender's Cables Ltd.	18·00
Coal Merchants Federation of Great Britain	30·00
Community Council of Lancashire	2·10
Federation of Owner-Occupier's & Owner-Resident's Association Ltd.	3·15
Furness District Federation of Owner-Occupiers' Association	2·10
Lancashire & District Coke Distributors Association	30·00
Macclesfield Civic Society ...	1·50
Manchester & District Regional Clean Air Council	18·00
Mercer & Sons Ltd.	1·05
Merseyside & North Wales Electricity Board	61·00
North-Western Electricity Board	89·00
Refuge Assurance Co. Ltd. ...	12·60
South-East Lancashire & North Cheshire Consultative Committee for the Investigation of Atmospheric Pollution... ...	2·10
Taymar Ltd.	2·10
Tillotsons Newspapers Ltd. ...	5·25
Warrington Local Medical Committee	2·10

Individual Members

Amende, H. F.	1·00
Ault, H.	1·05
Bayes, Mrs. M.	3·00
Behrens, A.	0·50
Bibby, H. P.	2·10
Brown, P. S.	1·50
Cass, H. V.	1·50
Christian, F. V.	1·53
Clusky, H.	1·50
Cooper, Miss I.	1·50
Cooper, R. I.	1·50
Darbyshire, Mrs. L. N.	1·50
Dearden, Mr. & Mrs. J.	3·00
Fallows, W. B.	1·50
Farquharson, G. W.	1·50
Forsyth, Mrs. L. A.	1·50
Franklin, E. J.	1·05
Franklin, N. J.	1·05
Gee, J.	1·50
Gee, Mrs. J.	1·50
Gibbons, E. B.	2·00
Graham, Mrs. E. M.	1·50
Graham, G. M.	1·50
Hall, A.	1·50
Hall, E. N....	1·50
Halliday, A. C.	1·50
Hallows, V. K.	1·50
Hayhurst, H.	1·05
Heald, Dr. G. E.	1·05
Hendy, Dr. B.	1·05
Howe, A. J.	1·50
Jackson, C. L.	1·05
Jewsbury, S.	1·50
Keddie, Dr. J. T. C.	1·05
Kitchener, The Rt. Hon., The Earl	1·00
Kirk, W. R.	1·50
Knight, R. F.	1·50
Lane, Mrs. W.	1·50
Langford, A. S.	0·53
Leech, Dr. P. W.	1·05
Lees, Miss M.	1·50
Lloyd, A.	1·50
MacWilliam, Dr. H. H.	0·75
Mather, Sir William	1·50
Mess, H.	1·50
Mitchell, L. A.	1·10
Moore, H.	1·10
Norwood, Mrs. D. B.	1·50
Pennington, H.	1·05
Pike, Miss I. M.	1·50
Polding, W. W.	0·53
Poller, Mrs. H.	1·50
Pollitt, W. E.	1·50
Rae, K. F.	1·50
Richards, J. E.	1·50
Schofield, B. W.	1·50
Shaw, Mrs. M.	1·50
Smith, W.	1·50
Stanyard, R. J.	1·50
Stringer, F. W.	1·50
Taylor, A.	1·50
Taylor, Mrs. A. E.	1·05
Taylor, Mrs. E.	1·50
Taylor, S.	1·50
Thomas, F. L.	1·05
Thorpe, J. A.	1·50
Topham, Mrs. D. A.	1·50
Vanstone, H. B.	1·50
Viney, N. H.	1·05
Ward, A. G.	1·50
Warren, D.	1·50
Williams, W. B.	1·00
Williamson, J. G.	0·75
Wood, Mrs. C.	1·50

NORTH-EAST DIVISION

Local Authority Members

Ashington U.D.C.	10·00
Barnard Castle R.D.C.	8·00
Bedlingtonshire U.D.C.	10·00
Bishop Auckland U.D.C. ...	10·00
Blaydon U.D.C.	10·00
Boldon U.D.C.	8·00
Brandon & Byshottles U.D.C. ...	8·00
Castle Ward R.D.C.	10·00
Chester-le-Street R.D.C.	10·00
Chester-le-Street U.D.C. ...	8·00
Consett U.D.C.	10·00
Crook & Willington U.D.C. ...	8·00
Darlington Cpn.	7·35
Durham R.D.C.	10·00
Felling U.D.C.	10·00
Gateshead Cpn.	32·00
Gosforth U.D.C.	10·00
Hartlepool Cpn.	19·00
Hebburn U.D.C.	8·00
Hetton U.D.C.	8·00
Houghton le Spring U.D.C. ...	10·00
Jarrow Cpn.	10·00
Lanchester R.D.C.	8·00
Longbenton U.D.C.	10·00
Morpeth Cpn.	8·00
Newburn U.D.C.	10·00
Newcastle-upon-Tyne Cpn. ...	35·00
Northumberland C.C.	60·00
Prudhoe U.D.C.	8·00
Ryton U.D.C.	8·00
Seaham U.D.C.	10·00
Sedgefield R.D.C.	10·00
Shildon U.D.C.	8·00
Skelton & Brotton U.D.C. ...	8·00
South Shields Cpn.	32·00
Spennymoor U.D.C.	8·00
Stanley U.D.C.	10·00
Sunderland	26·25
Teesside Cpn.	45·00
Tynemouth Cpn.	13·00
Wallsend Cpn.	10·00
Washington U.D.C.	8·00
Whickham U.D.C.	10·00
Whitley Bay Cpn.	10·00

Corporate Members

American Air Filter (Great Britain) Ltd.	18·00
Head Wrightson & Co. Ltd ...	18·00
Head Wrightson Iron & Steel Works Eng. Ltd.	30·00
Imperial Chemical Industries Ltd.	18·00
Newcastle Regional Hospital Board	18·00
North-Eastern Electricity Board	52·00
Northern Coke Distributor's Association	18·00
Proctor & Gamble Ltd. (Engineering Division)	18·00
University of Newcastle-upon-Tyne	3·15

Individual Members

Angus, Col. E. G.	3·15
Atkinson, E.	15·00
Atkinson, H.	0·75
Calvert, Mrs. M. R.	1·50
Carr, W.	1·50
Chambers, A.	1·50
Eve, M. E.	1·50
Horn, R.	1·50
Isaac, Professor, P. C. G. ...	2·00
Nisbet, R. F.	1·50
Ogilvie, Dr. A. G.	1·05
Smith, R. D.	1·05
Spriggs, Dr. E. A.	1·50
Thomas, D. M. C.	1·50

YORKSHIRE DIVISION

Local Authority Members

Adwick-le-Street U.D.C. ...	8·00
Aireborough U.D.C.	10·00
Barnsley Cpn.	19·00
Batley Cpn.	10·00
Bentley with Arksey U.D.C. ...	8·00
Bingley U.D.C.	10·00
Bradford Cpn.	40·00
Bridlington Cpn.	10·00
Brighouse Cpn.	10·00
Castleford Cpn.	10·00
Colne Valley U.D.C.	8·00
Conisbrough U.D.C.	8·00
Cudworth U.D.C.	8·00
Darton U.D.C.	8·00
Dearne U.D.C.	10·00
Denby Dale U.D.C.	8·00
Dewsbury Cpn.	13·00
Doncaster Cpn.	19·00
Doncaster R.D.C.	19·00
Elland U.D.C.	8·00
Halifax Cpn.	19·00
Harrogate Cpn.	13·00
Heckmondwike U.D.C.	8·00
Hemsworth R.D.C.	13·00
Hemsworth U.D.C.	8·00
Hepton R.D.C.	8·00
Holmfirth U.D.C....	8·00
Horbury U.D.C.	8·00
Horsforth U.D.C....	8·00
Hoyland Nether U.D.C.	8·00
Huddersfield Cpn.	32·00
Ilkley U.D.C.	8·00
Keighley Cpn.	2·10
Kingston-upon-Hull Cpn. ...	30·00
Knottingley U.D.C.	8·00
Leeds Cpn.	60·00
Meltham U.D.C.	8·00
Mexborough U.D.C.	8·00

	£—p
Mirfield U.D.C.	8·00
Morley Cpn.	10·00
Normanton U.D.C.	8·00
North Riding of Yorkshire C.C.	40·00
Ossett Cpn.	8·00
Otley U.D.C.	8·00
Pontefract Cpn.	10·00
Pudsey Cpn.	10·00
Queensbury & Shelf U.D.C.	8·00
Rawmarsh U.D.C.	8·00
Rothwell U.D.C.	10·00
Rotherham Cpn.	19·00
Royston U.D.C.	8·00
Scarborough Cpn.	10·00
Sheffield & District Clean Air Committee	60·00
Shipley U.D.C.	10·00
Skipton U.D.C.	8·00
Sowerby Bridge U.D.C.	2·00
Spenborough Cpn.	10·00
Stanley U.D.C.	10·00
Swinton U.D.C.	8·00
Thorne R.D.C.	10·00
Todmorden Cpn.	8·00
Wakefield Cpn.	13·00
Wakefield R.D.C.	8·00
Wath-upon-Derne U.D.C.	8·00
Wombwell U.D.C.	8·00
Worsbrough U.D.C.	8·00
Wortley R.D.C.	10·00
York Cpn.	5·25

Corporate Members

Barnsley District Coking Co. Ltd.	18·00
Bradford Civic Society	1·05
Clayton, Son & Co. Ltd.	2·10
Coke Oven Managers' Association	5·25
Holmes, W. C. & Co. Ltd.	30·00
John Thurley Ltd.	30·00
North Eastern Coke Distributors Association	18·00
North Eastern Gas Board	84·00
Universal Machinery & Services Ltd.	15·75
West Riding Clean Air Advisory Council	5·25
Yorkshire Electricity Board	94·00

Individual Members

Armitage, F.	1·50
Ball, J. D.	1·50
Brett-Littlechild, R.	1·50
Brown, G. L.	2·10
Burn, Dr. A. T.	1·50
Chambers, C. A.	1·50
Crocker, P.	1·50
Etheringham, H.	1·05
Fleming, I.	1·50
Gifford, Dr. P. W. W.	1·50
Goodfellow, J.	1·50
Griffiths, D. P.	1·05
Hackney, E. S.	1·50
Hutton, Dr. K. B.	10·00
Jackson, Dr. Mary	1·50
Jervis, Dr. J. J.	1·05
Jones, L.	1·05
Jordon, H. H.	1·50
Machen, C.	1·50
Marshall, G. C.	1·25
Middlebrook, C. J.	1·50
Miller, Dr. J. E.	1·05
Moore, L.	0·75
Newell, R. A.	1·50
Saxton, W. T.	1·50
Scarghill, M.	1·50
Sewell, Dr. P.	1·50
Sharp, A. I.	1·50
Slater, D. J.	1·05
Tuckley, B. E.	1·05
Walden K. H.	1·50
Winfield, E. J.	1·05
Wood, F. T.	1·50

WEST MIDLAND DIVISION

Sustaining Members

	£—p
West Midlands Gas Board	210·00

Local Authority Members

Aldridge-Brownhills U.D.C.	15·75
Atherstone R.D.C.	10·00
Bedworth U.D.C.	10·00
Birmingham Cpn.	60·00
Burton upon Trent Cpn.	13·00
Cannock R.D.C.	10·00
Cannock U.D.C.	13·00
Coventry Cpn.	40·00
Dudley Cpn.	35·00
Halesowen Cpn.	13·00
Hereford Cpn.	10·00
Kidderminster Cpn.	10·00
Leamington Spa Cpn.	10·00
Meriden R.D.C.	13·00
Newcastle-under-Lyme Cpn.	19·00
Nuneaton Cpn.	13·00
Redditch U.D.C.	10·00
Rugby Cpn.	13·00
Rugeley U.D.C.	8·00
Seisdon R.D.C.	2·10
Solihull Cpn.	32·00
Stafford Cpn.	13·00
Staffordshire C.C.	60·00
Stoke-on-Trent Cpn.	40·00
Stone R.D.C.	8·00
Sutton Coldfield Cpn.	13·00
Tamworth Cpn.	10·00
Wallsall Cpn.	35·00
Warley Cpn.	32·00
Warwick R.D.C.	10·00
Warwick Cpn.	8·00
Warwickshire C.C.	18·90
Wellington (Salop) U.D.C.	3·15
West Bromwich Cpn.	32·00
Wolverhampton Cpn.	40·00
Worcester Cpn.	13·00

Corporate Members

Cradley Boiler Co. Ltd.	18·00
Danks, Edwin & Co. (Oldbury) Ltd.	18·00
Gibbons Brothers Ltd.	25·00
Guest, Keen & Nettlefolds Ltd.	50·00
Midland Counties Coke Distributors Association	18·00
Midlands Electricity Board	95·00
Midlands Joint Advisory Clean Air Council	10·50
Nuneaton Fume, Smoke and Noise Abatement Society	3·15
Warwickshire Clean Air Council	30·00
University of Aston-in-Birmingham—Department of Building	18·00

Individual Members

Barnes, Mr. & Mrs. A. J.	1·05
Berry, R. J.	1·50
Busby, H. G. T.	1·50
Cockerham, Dr. R. G.	1·50
Darby, K.	1·50
Darnell, J. R.	1·50
Dickinson, S.	1·50
Dingley, W. L.	1·50
Donaldson, I. J.	1·50
Fletcher, J. P.	1·25
Garner, N. A.	1·50
Gillet, J. A.	2·10
Gittins, M. J.	1·50
Grimmett, P. H. G.	1·50
Hockton, D.	2·50
Knightsbridge, C. R.	1·50
Learmonth, G. S.	1·50
Longley, J. C.	1·50
Lowbridge, H. E. T.	1·50
Martime, Dr. W. R.	2·00
Orchard, G. W.	1·05
Owen, A. G.	1·50
Pringle, Dr. E.	1·05
Reynolds, F.	1·50
Reynolds, K.	3·00
Roberts, R. E. J.	2·00
Smart, R. C.	0·53
Steadman, A. T.	1·05
Taylor, Mr. & Mrs. C. B.	2·10

EAST MIDLANDS DIVISION

Sustaining Members

	£—p
Coalite & Chemical products Ltd.	400·00
East Midlands Gas Board	150·00

Local Authority Members

Alfreton U.D.C.	8·00
Basford R.D.C.	13·00
Beeston & Stapleford U.D.C.	13·00
Belper R.D.C.	8·00
Belper U.D.C.	8·00
Bingham R.D.C.	10·00
Blaby R.D.C.	13·00
Blackwell R.D.C.	10·00
Bolsover U.D.C.	8·00
Boston Cpn.	10·00
Cambridge City	10·00
Carlton U.D.C.	10·00
Chesterfield Cpn.	6·83
Chesterfield R.D.C.	13·00
Clay Cross U.D.C.	8·00
Clowne R.D.C.	8·00
Coalville U.D.C.	10·00
Corby U.D.C.	10·00
Derby Cpn.	35·00
Dronfield U.D.C.	8·00
Eastwood U.D.C.	8·00
Gainsborough U.D.C.	8·00
Glanford Brigg R.D.C.	10·00
Grantham Cpn.	10·00
Grimsby Cpn.	19·00
Heanor U.D.C.	8·00
Hinckley U.D.C.	10·00
Hucknall U.D.C.	10·00
Ilkeston Cpn.	10·00
Ipswich Cpn.	32·00
Irthlingborough U.D.C.	8·00
Kettering Cpn.	10·00
King's Lynn Cpn.	10·00
Kirkby-in-Ashfield U.D.C.	8·00
Leicester Cpn.	40·00
Lincoln City	19·00
Lincoln County Council (Parts of Kesteven)	10·50
Lincoln County Council (Parts of Lindsay)	10·50
Long Eaton U.D.C.	10·00
Loughborough Cpn.	10·00
Lowestoft Cpn.	10·00
Mansfield Cpn.	13·00
Mansfield Woodhouse U.D.C.	8·00
Newark Cpn.	8·00
Norwich Cpn.	32·00
Nottingham Cpn.	40·00
Nottinghamshire C.C.	10·50
Old Fletton U.D.C.	8·00
Peterborough Cpn.	13·00
Repton R.D.C.	2·10
Rushden R.D.C.	8·00
Scunthorpe Cpn.	13·00
Southwell R.D.C.	10·00
Staveley U.D.C.	8·00
Sutton-in-Ashfield U.D.C.	10·00
Swadlincote U.D.C.	8·00
Wellingborough U.D.C.	10·00
Welton R.D.C.	8·00
Wisbech Cpn.	8·00
Worksop Cpn.	10·00
Worksop R.D.C.	8·00

Corporate Members

Dust Control Equipment Ltd.	18·00
Eastern Electricity Board	98·00
East Midlands Electricity Board	77·00
Franklin, Charles Ltd.	2·10
Low Temperature Coal Distillers Association	18·00

Individual Members

Allison, G.	2·10
Ballard, W. A.	1·50
Brown, J. A.	1·50
Catlow, J.	3·15
Cooper, S.	1·50
Crowther, Dr. J. S.	1·05
Darby, F. M.	1·50

	£—p
Davies, Dr. D.	1·05
Dilworth, J.	1·50
Ewart, E. S.	1·50
Ford, G. E.	1·50
Harris, T. A.	1·50
Harrop, J. A.	2·00
Hiller, G. A.	1·50
McDonald, J. D.	1·50
Needham, C. E.	2·00
Pane, R.	2·00
Pleister, Miss, E. M. J.	1·05
Ruffner, J.	2·50
Scopes, F. V.	1·50
Smith, Lt. Col. C. H.	2·10
Turner, Miss. H. E.	2·00
Turner, T. Henry	2·00
Wade, A.	1·50
Waring, F. L.	5·25
Weldon, Miss G. M.	2·10
Wilkinson, J. R.	1·50
Wright, P. F.	1·50

SOUTH WEST DIVISION

Local Authority Members

Bath Cpn.	19·00
Bathavon R.D.C.	0·53
Bridgwater Cpn.	1·05
Bristol Cpn.	45·00
Cheltenham Cpn.	19·00
Dursley R.D.C.	8·00
Gloucester Cpn.	19·00
Gloucestershire County Council	5·00
Keynsham U.D.C.	1·50
Lydney R.D.C.	8·00
Mangotsfield U.D.C.	1·05
Norton Radstock U.D.C.	1·50
Poole Cpn.	19·00
Shepton Mallet R.D.C.	0·53
Sherborne U.D.C.	1·50
Sodbury R.D.C.	4·20
Stroud U.D.C.	8·00
Swindon Cpn.	19·00
Tetbury R.D.C.	0·53
Tewkesbury Cpn.	2·10
Thornbury R.D.C.	10·00
Weston-Super-Mare Cpn.	10·00
West Penwith R.D.C.	8·00
Weymouth & Melcombe Regis Cpn.	10·00
Corporate Members	
Imperial Tobacco Co. (of G.B. & Ireland) Ltd.	30·00
South Western Electricity Board	42·00
South Western Gas Board	52·50
Individual Members	
Archard, P.	1·50
Best, J. K.	1·50
Blampied, F. C.	1·50
Cowley, Lady	3·00
Colehan, J. E.	1·50
Crook, S. C.	1·05
Draper, P.	1·50
Harris, J.	1·05
Kenney, J. G.	1·50
Redston, R. V.	1·50
Trevillion, Mrs. F.	1·50
Wakeley, R. W.	1·50
Wallis, Mrs. E.	1·50
Williams, J. R.	1·50
Whiting, G. C.	2·00

SOUTH EAST DIVISION

Sustaining Members

	£—p
British Petroleum Co. Ltd.	150·00
British Steel Corporation	750·00
Central Electricity Board	438·00
Coal Merchants Federation of Great Britain	100·00
Electricity Council	438·00
Esso Petroleum Company Ltd.	200·00
Gas Council	700·00
Greater London Council	100·00
Imperial Chemical Industries Ltd.	100·00
National Carbonising Co. Ltd.	100·00
National Coal Board	1,000·00
North Thames Gas Board	210·00
Shell International Petroleum Co. Ltd.	250·00
Shell-Mex and B.P. Ltd.	250·00
South Eastern Gas Board	210·00

Local Authority Members

	£—p
Amersham R.D.C.	13·00
Aylesbury Cpn.	10·00
Barking, London Borough of	26·25
Barnet, London Borough of	40·00
Basildon U.D.C.	32·00
Bedford Cpn.	13·00
Bedfordshire C.C.	40·00
Bexley, London Borough of	35·00
Bishop's Stortford U.D.C.	8·00
Bletchley U.D.C.	10·00
Bournemouth Cpn.	2·10
Brent, London Borough of	40·00
Brentwood U.D.C.	13·00
Brighton Cpn.	32·00
Bromley, London Borough of	40·00
Bullingham R.D.C.	13·00
Bushey U.D.C.	8·00
Camden, London Borough of	35·00
Chatham Cpn.	13·00
Chertsey U.D.C.	10·00
Chesham U.D.C.	8·00
Cheshunt U.D.C.	10·00
Chigwell U.D.C.	13·00
Colchester Cpn.	13·00
Crawley U.D.C.	10·00
Croydon, London Borough of	10·50
Cuckfield R.D.C.	4·20
Dartford Cpn.	10·00
Dartford R.D.C.	13·00
Dover Cpn.	10·00
Ealing, London Borough of	40·00
Eastbourne Cpn.	13·00
Easthampstead R.D.C.	13·00
Eastleigh Cpn.	10·00
Elstree R.D.C.	10·00
Enfield, London Borough of	40·00
Epping & Ongar R.D.C.	10·00
Epsom & Ewell Cpn.	13·00
Esher U.D.C.	13·00
Essex County Council	3·15
Eton R.D.C.	13·00
Farnborough U.D.C.	2·10
Folkestone Cpn.	10·00
Gillingham Cpn.	19·00
Gosport Cpn.	1·50
Gravesend Cpn.	10·00
Greenwich, London Borough of	35·00
Guildford Cpn.	13·00
Guildford R.D.C.	13·00
Hackney, London Borough of	35·00
Hambledon R.D.C.	10·00
Hammersmith, London Borough of	35·00
Harlow U.D.C.	19·00
Harrow, London Borough of	35·00
Harwich Cpn.	8·00
Hastings Cpn.	13·00
Havant & Waterloo U.D.C.	32·00
Havering, London Borough of	40·00
Hemel Hempstead Cpn.	13·00
High Wycombe Cpn.	13·00
Hillingdon, London Borough of	35·00
Hitchin U.D.C.	10·00
Hoddesdon U.D.C.	8·00
Hounslow, London Borough of	35·00
Islington, London Borough of	40·00
Kensington & Chelsea, London Borough of	3·15
Kent County Council	5·15
Kingston-Upon-Thames, Royal Borough of	32·00
Lambeth, London Borough of	40·00
Leatherhead U.D.C.	2·10
Lewisham, London Borough of	40·00
Littlehampton U.D.C.	1·57
London Cpn.	60·00
Luton Cpn.	32·00
Luton R.D.C.	10·00
Maidenhead Cpn.	10·00
Merton, London Borough of	35·00
New Forest R.D.C.	13·00
Newham, London Borough of	5·00
Northfleet U.D.C.	10·00
Oxford Cpn.	32·00
Portsmouth Cpn.	10·50
Reading Cpn.	5·15
Redbridge, London Borough of	35·00
Reigate Cpn.	13·00
Richmond-Upon-Thames, London Borough of	35·00
Rickmansworth U.D.C.	10·00
Rochester Cpn.	10·00
St. Albans Cpn.	13·00
St. Albans R.D.C.	10·00
Sittingbourne & Milton U.D.C.	10·00
Slough Cpn.	19·00
Southampton Cpn.	1·50
Southend-On-Sea Cpn.	2·10
Southwark, London Borough of	40·00
Southwick U.D.C.	8·00
Staines U.D.C.	13·00
Strood R.D.C.	10·00
Sutton, London Borough of	32·00
Thurrock U.D.C.	32·00
Tower Hamlets, London Borough of	35·00
Tunbridge Wells Cpn.	1·50
Walton & Weybridge U.D.C.	13·00
Wandsworth, London Borough of	40·00
Watford Cpn.	19·00
Watford R.D.C.	13·00
Welwyn Garden City U.D.C.	10·00
Westminster Cpn.	35·00
New Windsor, Royal Borough of	10·00
Windsor R.D.C.	8·00
Wolverton U.D.C.	8·00
Worthing Cpn.	2·10
Wycombe R.D.C.	13·00
Corporate Members	
Allied Ironfounders Ltd.	18·00
Ambuco Ltd.	18·00
Association of Public Health Inspectors	18·00
Beacon Villages Association	1·05
B.I.C.C.E.R.I. Ltd.	18·00
British Independent Steel Producers Association	75·00
British Medical Association	18·00
Buckle, G. H. & Partners	30·00
Burmah Oil Trading Ltd.	18·00
Caltex Services Ltd.	18·00
Centri-Spray Ltd.	30·00
Charrington, Gardner Locket & Co. Ltd.	31·50
Chemical Construction (G.B.) Ltd.	9·00
Coal Utilisation Council	36·75
College of Fuel Technology	18·00
Drummond Dust & Fume Extractors Ltd.	5·00
Dust Suppression Ltd.	18·00
Eastern Gas Board	84·00
Electrical Association for Women	30·00
Flaregas Engineering	30·00
Federation of British Cremation Authorities	2·10
Ford Motor Co. Ltd.	18·00
A. Guinness, Son and Co. (Park Royal) Ltd.	18·00
Hamold Leather Mfg. Co. Ltd.	1·05
Holliday Fellowship Ltd.	2·10
Institute of Fuel	30·00
Institution of Gas Engineers	18·00
Institute of Petroleum	30·00
John Zinc Co. Ltd.	18·00
Joy Trading Cpn.	10·00
London & Counties Coke Distributors Association	31·50
London Electricity Board	79·00
London Trades Council	2·10
London Transport Board	26·25
Marshall & Parsons Ltd.	3·00
Metal Box Co. Ltd.	18·00
Mobil Oil Co. Ltd.	52·50
Municipal Passenger Transport Association (Inc.)	15·75
National Federation of Coke Distributor's Associations	52·50

	£—p
Public Transport Association	21·00
Radiation Ltd.	31·50
Rickett Cockerell & Co. Ltd.	7·35
Road Haulage Association Ltd.	18·00
Royal Society of Health	18·00
Solid Smokeless Fuels Federation	52·50
South Eastern Electricity Board	60·00
Southern Electricity Board	83·00
Southern Gas Board	75·00
Sturtevant Engineering	2·10
Trist, Ronald & Co. Ltd.	31·50
United Kingdom Atomic Energy Authority	18·00
White Drummond & Co. Ltd.	3·15
Women's Advisory Council on Solid Fuel	18·00
Women's Gas Federation	30·00
Individual Members	
Abell, R. H.	1·50
Acworth, Miss E. A.	1·05
Acworth, Miss W. B.	5·25
Albone, Dr. E. S.	1·50
Armstrong, F. W.	1·00
Barrie, W. L.	5·25
Bartlam, J. N.	1·50
Bastable, N.	1·05
Baver, F. W.	1·50
Beaumont, M.	2·10
Bottom, D. W.	1·50
Boult, Sir Adrian C.	1·50
Boult, Miss Olive	1·50
Boyd, Miss D.	1·05
Bradbury-Williams, J. C.	1·50
Bradford, S. G.	1·50
Bradshaw, N. F.	1·50
Brown, A. W.	1·05
Brown, T. J.	1·05
Bryant, Miss P. M.	2·00
Buddeley, Dr. A.	1·50
Buist, Commander C.	10·50
Burridge, I. G.	1·50
Butler, J. W.	2·10
Capes, F. B.	0·75
Carter, Dr. J. S.	4·20
Chapman, W. B.	1·50
Chatfield, A. J.	1·50
Chesney, Miss T. R.	1·05
Chivers, D. P.	0·75
Clarke, Dr. R. T. V.	1·50
Clarke, S. H.	1·00
Cleverden, Mrs. E.	1·50
Clinch, H. G.	1·50
Coker, W. G.	1·50
Colville, Lt. Com. R. F.	1·50
Cotton, S. A.	1·50
Courtier, G. B.	1·50
Cousin, Lt. Col. A. J.	1·50
Cronk, J. J. T.	1·50
Crosby, A. S. B.	1·50
Curtis, B.	2·00
Darbyshire, Miss L. N.	1·50
Davies, P. M.	1·50
Davis, E. T. A.	1·50
Day, L. J.	1·50
Daynes, D. A.	1·50
Dimbleby, T. E.	1·50
Dobson, P. F.	1·05
East, R. G.	1·50
Eaton, Dr. F. J.	3·50
Ellis, P. T. A.	2·00
Evans, H. M.	1·50
Finley, Mrs. V.	1·50
Fletcher, J.	1·05
Forestor, Dr. C.	1·50
Fowle, Lady Honor C.	Life Member
Fox, Dr. R. H.	1·05
Gandy, Miss R. L.	2·10
Garland, G. E.	1·50
Gavin, M. J.	1·50
Gilbert, E. D.	1·50
Gillison, Dr. J. A.	2·10
Gimpel, Mrs. C.	2·10
Graves, T. G.	1·50
Green, J.	1·50
Greenhead, S.	1·50
Greenwood, Mrs. E. L.	2·10
Grove, Mrs. G. I.	1·50
Hales, J. S.	2·10
Held, P. E. J.	1·50
Henson, C. G.	1·50
Hickman, Miss V.	1·50
Hinde, Dr. P. T.	1·50
Hoppitt, H. B.	1·50
How, M. D.	1·50
Hulme, G. H.	1·50
Hussey, R.	1·50
Ibbetson, H.	2·10
Jackson, C.	1·50
Jackson, P. L.	1·50
James, B. W.	2·00
Jellis, F.	1·05
Jones, D. P. G.	1·50
Jones, W. L.	1·50
Kendall, Dr. J. D.	1·50
Kershaw, C. A.	1·05
Kirkpatrick, D. A.	1·50
Langwell, W. H.	1·05
Laundon, J. R.	1·50
Lax, Mrs. G.	1·05
Lee, S. A.	1·50
Leverson Gower, Mrs. V.	2·10
Lewin, J. U.	1·50
Little, J. W.	3·15
Lord, D. G.	1·50
Lovell-Burgess, Miss M.	1·50
MacNair, A. S.	1·05
Madelin, Sqn. Ldr. I.	0·75
Mason, J. K.	1·50
Matthews, Dr. N. E.	1·50
McLintock, Dr. S. W.	1·50
Medawar, Lady	1·00
Melland, Mr. B.	1·50
Mellins, Mrs. M. H.	1·50
Menuhin, Yehudi	1·05
Messenger, Mrs. J. P.	1·50
Messenger, W. E.	1·50
Miles, S. E.	2·00
Monkhouse, Dr. A. C.	1·50
Moore, Mrs. M. St. A.	1·50
Moreland, S.	1·50
Mowle, C. R.	1·50
Myers, M. R.	1·50
Nagle, B. R.	1·50
Nonhebel, Dr. G.	1·50
Oliver, G. T.	1·50
Parker, Dr. A.	5·25
Parker, Dr. R. A.	2·00
Parkinson, A. C.	1·05
Parry, M.	75·00
Pavey, A. F.	1·05
Pedrick, F.	1·50
Pennington, W. J.	1·50
Phillips, G. H.	1·50
Pinguex, L.	1·50
Poole, Mrs. W. M.	1·50
Potter, Dr. D. C.	1·50
Potter, Dr. N. M.	1·05
Preston, Dr. T. W.	1·05
Rayner, K. F.	1·50
Read, B.	1·50
Rendel, Dr. M. N.	1·50
Renwick, Dr. and Mrs. J.	1·00
Richardson, R. L.	4·00
Robinson, Mrs. E.	2·10
Rogers, E. C.	1·50
Rogers, Miss J. S.	1·00
Roper, Captain R.	0·53
Rosling, Miss E. M.	1·05
Rundle, L. G.	0·75
Sacher, Mrs. C. M. M.	1·50
Sansum, Mrs. E. B.	1·50
Saunders, Mrs. J.	1·50
Scorer, Professor R. S.	1·05
Scotson, D. A.	1·50
Seale, R. J.	1·50
Shackcloth, W.	1·50
Shanks, E. C.	0·75
Shieldhouse, B. S.	1·50
Shillito, D. E.	1·50
Skedge, N. C.	2·00
Smith, A. R.	2·10
Smith, Mrs. P.	1·05
Smith, R. C.	1·50
Sowby, Dr. F. D.	1·50
Spoor, Dr. N. L.	1·50
Stephenson, Dr. R. J.	2·00
Stewart, R. E.	2·00
Stubbs, G. C.	1·50
Sullivan, J. S.	1·05
Sutherland, J. W.	1·50
Taylor, C. P.	1·50
Thomas, R. B.	1·50
Thomas, R. F.	1·50
Todd, G. F.	2·10
Train, Dr. D.	1·50
Turner, Dr. W. C.	1·00
Vine, Mr. and Mrs. G. M.	2·10
Des Voex, Mrs. M. F.	5·25
Waddell, A.	0·75
Watson, Professor, H. E.	2·00
Wermann, J. C.	1·50
Westbrook, J.	1·05
White, Dr. H. D. J.	1·00
White, Mrs. C. P.	Life Member
Whitehead, B. G.	1·50
Wickens, A. A.	1·50
Wigan, H. N.	1·50
Williams, H. P.	2·00
Willison, Mrs. M. E.	2·00
Yarrow, Mr. C.	1·05

SOUTH WALES AND MONMOUTHSHIRE DIVISION

Local Authority Members	
Abercarn U.D.C.	8·00
Aberdare U.D.C.	10·00
Abertillery U.D.C.	6·67
Barry Cpn.	10·00
Bedwas & Machen U.D.C.	8·00
Bedwelty U.D.C.	10·00
Bridgend U.D.C.	8·00
Caerleon U.D.C.	8·00
Caerphilly U.D.C.	10·00
Cardiff Cpn.	40·00
Cardiff R.D.C.	10·00
Cwmbran U.D.C.	10·00
Ebbw Vale U.D.C.	10·00
Gellygaer U.D.C.	10·00
Glamorgan C.C.	60·00
Llanelli Cpn.	10·00
Llanelli R.D.C.	10·00
Llantrisant & Llantwit Fadne R.D.C.	10·00
Magor & St. Mellons R.D.C.	10·00
Merthyr Tydfil Cpn.	13·00
Monmouthshire County Council	40·00
Mountain Ash U.D.C.	10·00
Mynyddislwyn U.D.C.	8·00
Neath Cpn.	10·00
Newport Cpn.	32·00
Penarth U.D.C.	8·00
Pontypool U.D.C.	10·00
Pontypridd U.D.C.	10·00
Port Talbot Cpn.	13·00
Risca U.D.C.	8·00
Swansea Cpn.	32·00
Tredegar U.D.C.	8·00
Ystradgynlais R.D.C.	8·00
Corporate Members	
Ambercwmboi Clean Air Committee	1·01
Coal Merchants Federation of Wales	5·25
Coopers Mechanical Joints	10·00
South Wales Electricity Board	44·00
Swansea Port Health Authority	18·00
Wales Coke Distributors Association	18·00
Wales Gas Board	36·15
Individual Members	
Bacon, N. P.	2·10
Brownrigg, M. A.	1·50
Carter, L. J.	1·50
Clarke, J. A.	1·50
Harrop-Griffiths, H.	4·00
Harry, T. W.	1·05

OVERSEAS DIVISION

Local Authority Members	
Durban, Corporation of the City of (South Africa)	50·40

	£—p
Geleen, Municipality of (Netherlands)	9·90
Johannesburg, City of (South Africa)	20·00
Leichhardt, Municipality of (Australia)	10·50
Newcastle, City of (Australia)	2·10
Vereeniging, Town Council of (South Africa)	2·00
Corporate Members	
Air Pollution Research Group (South Africa)	6·30
China Light and Power Co. Ltd. (Hong Kong)	18·00
Du Pont De Nemours International S.A. (Switzerland)	18·00
Elex S.A. (Switzerland)	3·00
Hong Kong Electric Co. Ltd. (Hong Kong)	18·00
Individual Members	
Anderson, Mrs. P. M. (Australia)	1·05
Bezanes, Fernando (Spain)	2·00
Brandt, William G. Jr. (U.S.A.)	$5·00
Brunelle, Mrs. M. F. (U.S.A.)	$5·00
Buschman, C. H. (Netherlands)	1·50
Chamberlin, R. L. (U.S.A.)	$5·00
Chantler, P. (Cyprus)	4·20
Cutts, Chisholm (Australia)	1·50
Danson, J. (Rhodesia)	1·50
De Coster, J. P. (Belgium)	1·50
De Permentier, Paul R. (Belgium)	1·50
Doly, J. (U.S.A.)	1·50
Easterbrook, J. L. (South Africa)	3·00
Eldridge, J. L. (South Africa)	3·00
Eldridge, Gardner S. (Canada)	1·50
English, Dr. Bruce V. (U.S.A.)	$10·00
Easteban, Dr. Felix (Spain)	1·50
Feige, H. J. (Israel)	2·00
First, Professor Melvin W. (U.S.A.)	$10·00
Fitzgerald, J. L. (Ireland)	1·50
Froelicher, Miss F. M. (U.S.A.)	1·50
Fung, Lawrence (Hong Kong)	2·00
Gerhardsson, Gideon (Sweden)	1·50
Ginger, Roy C. (New Zealand)	1·50
Gladstein, Dr. Tunia M. (Israel)	1·50
Grafe, Dr. Kurt (Germany)	1·50
Griffin, R. (Rhodesia)	1·50
Hasselhuhn Bjorn (Sweden)	2·00
Heuson, Dr. E. Wendell (U.S.A.)	5·00
Hobbs, R. L. (Australia)	1·50
Hornbeck, D. D. (U.S.A.)	$5·00
Hooton, K. A. H. (U.S.A.)	1·50
Hunigen, Dr.-Ing Edmund (Germany)	1·50
Johnson, K. R. (South Africa)	2·00
Jones, Evan H. (South Africa)	1·50
Jones, Mrs. M. A. (South Africa)	1·50
Kettner, Dr. Helmut (Germany)	1·50
Mueller, Dr. Peter K. (U.S.A.)	1·50
O'Connor, Dr. T. C. (Ireland)	1·50
Pedrero, Dr. Pablo Sanz (Spain)	1·50
Pepperdine, E. C. (Gibraltar)	1·50
Plamondon, Sarto R. (Canada)	$5·00
Ratnasingam, M. (West Malaysia)	1·50
Rebello, Professor F. P. (Brazil)	1·50
Reifferscheid, Dr. Helmut.	1·50
Gueltiero, Rossi (Italy)	1·50
Ruft, C. D. (U.S.A.)	1·50
Smith, E. M. (U.S.A.)	$10·00
Sordelli, Dr. Danilo (Italy)	1·50
Strach, L. (Germany)	1·50
Sundberg, A. P. (Switzerland)	1·50
Taga Takahide (Japan)	1·50
Triffett, A. C. (Australia)	2·00
Wight, Dr. J. Earle (Canada)	1·50
Wise, William (U.S.A.)	$5·00

"ANTINQUINAMENTO 71"

Milan, November 1971

An International Anti Pollution Exhibition

and

An International Environment Conference

to be staged in Italy

Exhibition

To run from 14–19 November within the Milan Fair complex in 3 halls comprising 15,000 sq. metres, displaying equipment of all kinds used for the reduction of pollution and the preservation of the enviroment.

Conference

Will take place from 15–18 November in the Conference Centre at the Milan Fair Complex. There is seating capacity for 500 equipped with simultaneous translation facilities and visual aids. Papers will be presented on Air, Water, Marine, and Land pollution and on the Environment by scientists and industrialists from most European countries.

Further details may be obtained from the N.S.C.A., 134/137 North Street, Brighton. Telephone No. Brighton 26313.

Information About the Society

The forerunners of the Society were the Coal Smoke Abatement Society, established in London in 1899, the Smoke Abatement League of Great Britain (1909) concerned mainly with the Provinces and the National Smoke Abatement Society, formed in 1929 by the amalgamation of the two parent organisations. At a Special General Meeting held in April 1957, it was agreed unanimously to change the name of the Society to "National Society for Clean Air", and to seek incorporation as a company limited by guarantee, a licence being sought from the Board of Trade to omit the word limited. The Society assumed its new name and status as from 1st January, 1958.

For further information about membership, Executive Council and Committees, etc., reference should be made to the Society's Memorandum and Articles of Association and Byelaws.

Divisions

For electoral purposes and where it is desired, area organisation, the Society is now composed of the following geographical Divisions: (1) Scotland, (2) Northern Ireland, (3) North West, (4) North East, (5) Yorkshire, (6) West Midlands, (7) East Midlands, (8) South West, (9) South East, (10) South Wales and Monmouthshire. (See Byelaws for the Counties in each Division.)

Membership

The Society is wholly dependent on the contributions of its members for the growth and the maintenance of its work, and invites the support of all who sympathise with and wish to promote its objects. These are stated in full in the Memorandum of Association, but they may be briefly summarised as the securing throughout the United Kingdom of the maximum of natural light and air free from every form of pollution, particularly that arising from the combustion of fuel. There are three main classes of membership—for individuals, local authorities, and corporate bodies such as firms, public undertakings and institutions. Individual members and the representatives of other members have rights of nomination and voting in elections for Officers and Council. They receive, free of charge, the Society's quarterly journal *Clean Air* and other publications.

Corporate members who have branches or offices in Divisions of the Society other than that in which their Registered Office is situated may appoint Delegates to participate in the activities of those Divisions. Members are entitled to receive assistance and information on problems relating to air pollution. In addition to receiving notices of meetings and conferences organised nationally, they are entitled to participate in any activities organised by or within their Division. The Society's Subscription year is for the period 1st April to 31st March.

Associates

Any individual, local authority, institution or corporate body contributing less than the appropriate membership subscription may become an *Associate*, entitled to some of the privileges of membership, but not to those relating to nomination, voting and election to office. The minimum subscription for an Associate Member is £3.

Subscriptions

INDIVIDUAL MEMBERS—Not less than three pounds.

LOCAL AUTHORITY MEMBERS—Not less than the following amounts, according to population:

	£
less than 25,000	10
25,001 to 50,000	13
50,001 to 75,000	17
75,001 to 100,000	23
100,001 to 175,000	35
175,001 to 250,000	40
250,001 to 375,000	45
375,001 to 500,000	50

Over 500,000, £15 for each additional 1,000,000 of population or part thereof.

CORPORATE MEMBERS—Not less than forty pounds (four representatives and two delegates in each appropriate Division), or not less than twenty-three pounds (two representatives and one delegate in each appropriate Division).

(Under Article 5 (e) (ii) of the Society's Articles of Association, an Association or firm which is not incorporated can appoint representatives to act on its behalf, and obtain all the benefits of Corporate Membership.)

SUSTAINING MEMBERS—A member in any class subscribing not less than £100 a year.

SPECIAL CASES—The Executive Council may consider applications for membership on special terms as to subscriptions and otherwise. This rule is intended to apply in particular to local and other small voluntary associations wishing to become Corporate Members.

ASSOCIATES—Any sum that is less than the appropriate subscription for membership, but with a minimum of three pounds.

DONATIONS—The Society will be pleased to receive single or annual donations for any amount from non-members.

PUBLICATIONS—Annual subscriptions may be made for *Clean Air, Clean Air Year Book* and for other publications as issued. Details of such subscriptions will be sent on request.

PAYMENT OF SUBSCRIPTIONS—The first subscription should be forwarded with application for membership. This may be sent at any time, but will commence from 1st April, and back issues of *Clean Air* will be sent to new members. It is mutually advantageous if subscriptions are made by Banker's Order.

COVENANT DONATIONS—Annual contributions to the society may be made under covenant, the Society being recognised as a "charity" by the Commissioners of Inland Revenue for this purpose. By signing an agreement to subscribe a stated sum for a minimum of seven years the Society may claim the amount of income tax that has been paid on such contributions, thereby increasing the benefit it receives without additional cost to the donor. Further particulars and form of covenant will be forwarded on request.

Representatives and Delegates

Local authority and Corporate Members are entitled to appoint Representatives to exercise on their behalf the rights of membership with regard to nomination for office, voting, receipt of publications, etc. Corporate Members may appoint one or two representatives each, according to subscription, and Local Authority Members a number according to population, as follows:

Less than 75,000	2 representatives
75,001 to 175,000	3 representatives
175,001 to 375,000	4 representatives
375,001 to 500,000	5 representatives

Over 500,000, 1 additional representative for each additional 1,000,000 of population or part thereof.

Note: The Delegates mentioned previously participate in the activities of the Society *only* at Divisional level. A member's Representative exercises all the rights to which a member is entitled.

The names and addresses of Representatives should be forwarded on making application for membership, so that they may be entered in the Voting Register.

SERVICES TO MEMBERS

Information and Advice

Advice, assistance and information on matters relating to atmospheric pollution and its prevention is available free of charge to Members, provided that, where necessary, the request is approved by the Executive Council. If the information required is not immediately available to the Society's Information Department, the Society is prepared, on behalf of a Member, to obtain it from one of the specialised Information Bureaux.

Library

The Society's Library is available for the use of all Members, both for consultation in the Society's offices or for loan purposes. In most cases students or research workers can also use the facilities provided. It possesses an extensive collection of both British and foreign books, reports and pamphlets on air pollution and related subjects. In some cases the Society is the only organization in the United Kingdom receiving the publication. The Society is linked with various specialist and technical libraries, and when a publication relating to some special aspect of air pollution is not in the library, the Society can often borrow it through other sources. Applications should be made initially to the Librarian.

The library also possesses classified files of press-cuttings and a classified collection of photographs (mainly black and white, some coloured) depicting domestic and industrial smoke; damage to buildings, stonework and plants and other allied subjects. These are suitable for reproduction and/or display purposes. Prints may be inspected at the Society's offices, or a selection will be sent by post if details of requirements are given. The copyright of the photograph is retained by the photographer and where reproduction fees are chargeable, the inquirer should communicate with the photographer. The Library does not hold any negatives.

A small collection of slides and film-strips are available for loan but two or three weeks' advance notice should be given for these. A comprehensive list of films available from other sources is given elsewhere in this Year Book.

Lectures

The Society will be pleased to help members and others in any part of the country to arrange lectures and talks of all kinds on atmospheric pollution and related subjects.

Exhibitions

The Society is prepared to consider participating in suitable exhibitions, and has a mobile modular exhibition stand available for this purpose.

Publicity Advisory Service

The Society's Publicity Advisory Service is available to help Local Authorities and Corporate Members with their Clean Air Publicity, especially when Smoke Control Orders are pending.

The Service advises members on display material, its arrangement for exhibitions, stands, etc., and supplies information on other publicity activities such as public meetings, local press features and correspondence, educational work in schools, women's organisations, etc.

No charge is made for this service to members.

Exhibition Display Material

The Society has several exhibition units available for loan by local authorities and corporate members. These units are adaptable for displays ranging from 20 sq. ft. to 300 sq. ft. of floor space, and are complete with their own graphics and lighting.

Demand for these units is heavy particularly in the spring and autumn, and it is essential that inquiries are made as far in advance as possible.

A charge of £5 is made for the loan of these units plus the cost of carriage.

Posters

The Society has a number of coloured and line posters available, ranging in price from 12p per copy (double crown) to £10 per 100 copies. Post and packing extra.

The full list of posters available is as follows:

1. *Clean Air is Your Affair*
2. *Prevent Air Pollution—Britain's Biggest Headache*
3. *Lungs, Plants, Animals, Buildings and Your Pocket are being attacked by Polluted Air*
4. *Couldn't You do with some Clean Air?*
5. *Road Vehicle Pollution.*

Wall Chart

For school use, 44 in × 25 in. (40p including Lecture Notes).

Leaflets

Inquiries are invited on the supply of publications, give-away leaflets, etc., for special purposes. Particulars of these are given below. Postage and packing extra.

1. "Clean Air Begins at Home".
   £1·13 per 100 or £9 per 1000.
2. "Smoke Affects Your Health & Your Wealth."
   £1·13 per 100 or £9 per 1000.
3. "The Air You Breathe".
   £1·13 per 100 or £9 per 1000.
4. Clean Air Bookmarks.
   20p per 100
   £1·50 per 1000.

General Publications

The rates of postage and packing on the following are as follows:

Below 50p add 5p towards postage and packing. Between 51p and £1 add 10p. Over £1 add 20p.

1. "Clean Air". The Society's quarterly magazine. News, articles, photographs and comments. £1·10 per annum post free. 30p per copy.
2. "Clean Air Year Book" published annually. Price 60p per copy.
3. Clean Air: Notes for Teachers and Lecturers. 25p per copy.
4. Fumifugium. Paper cover 13p. Cloth cover 25p.
5. Sulphur Dioxide. 15p.
6. Air Pollution from Road Vehicles. 20p.
7. Towards Cleaner Air—A Survey of Air Pollution. 15p.
8. The Law Relating to Air Pollution—a summary of legislation. 15p.

Divisional Reports

Northern Ireland Division

The Annual General Meeting of the Division was held in B.M.A. House, 609 Ormeau Road, Belfast 7, on Wednesday, the 7th January, 1970. Mr. R. Campbell Brown, Director of Research and Education, Davidson and Co. Ltd., was re-elected Chairman and Mr. W. Jenkins, Chief Public Health Inspector, City of Belfast, was re-elected Deputy Chairman.

Following the election of office bearers Mr. W. J. Durdin of the Meteorological Office gave an illustrated lecture entitled "The Weather and Air Pollution". At the conclusion of this address the Chairman expressed the thanks of the meeting to Mr. Durdin.

The main event of the year was the Autumn one day meeting held in October in Belfast and attracting a record number of delegates. The first paper "European Conservation Year—with special reference to Air Pollution" was presented by Mr. Robin Baillie, M.P. This proved to be an outstanding opening to the meeting and no one could have failed to have been impressed by Mr. Baillie's sincere and articulate address, which covered all aspects of air pollution and gave us an insight into the political problems involved. The second paper, "The Incineration of Waste Materials" was presented by Mr. A. T. Traynor, M.A.P.H.I., M.Inst.P.C., M.R.S.H. This paper proved to be the highlight of the day and Mr. Traynor won the admiration of all those present by his clear and concise presentation of what is an extremely technical and complex subject. The long and lively discussion at the conclusion of the address showed quite clearly that the interest of the audience had been stimulated and aroused. After a pleasant lunch the final session of the day got under way. This was entitled "Viewpoints of the Fuel Industries on the Clean Air Act (N.I.) 1964", and it took the form of a short address by each of four representatives from the solid-fuel, oil, electricity and gas industries. Those taking part were:—Mr. Malcolm Edwards, Director (Industrial and Domestic Sales), N.C.B., London; Mr. G. G. Rivington, Regional Domestic Manager, Shell-Mex and B.P. Ltd., Glasgow; Mr. W. Crossley, General Manager, Electricity Board for Northern Ireland; and Mr. J. M. Dow, Engineer and Manager, Belfast Corporation Gas Department. Needless to say, an extremely lively discussion took place at the conclusion of the four papers.

During the year the Ministry of Health and Social Services gave approval to two Smoke Control Areas in Ballymena and Newtownabbey and in December the Ministry confirmed a Smoke Control Order submitted by Downpatrick U.D.C. By the end of 1970 there were 31 Smoke Control Orders in operation and others are in the pipeline either awaiting approval or confirmation.

The Ulster Society for the Preservation of the Countryside and National Trust organised an exhibition in Queen's University, Belfast, in November as part of the Northern Ireland contribution to European Conservation Year and the Divisional Council were happy to have a part in this exhibition. The Division also participated in the Home Heating Exhibition organised by the various fuel interests and held in Belfast in October.

B. P. HANNA,
Hon. Secretary.

Scottish Division

The Division and the Executive Committee each met on two occasions during the year. The main events of the year were the Conference and Exhibition held in Glasgow during May.

The Conference was held on 21st and 22nd May and was very well attended. It was opened by Lord Hughes, Minister of State at the Scottish Office, and papers were given by distinguished speakers. The subjects included the effects of pollution on soils and vegetation, and pollution problems from iron and steel works, waste incineration, and motor vehicles. These papers proved of great interest to the delegates.

The Division also organised an Exhibition which was held in Glasgow from 18th to 22nd May. All the fuel interests were represented at this Exhibition and in addition, Glasgow Corporation, the Scottish Information Office and the Society had stands. The Exhibition was open to the public from 2 p.m. to 10 p.m. each day, and it was a very worthwhile venture both from a financial point of view and as an exercise in public relations for the cause of clean air.

During the course of the year, Mr. Malcolm M. Beaton's term of office as President of the Division came to an end and Dr. W. A. Horne, the former Medical Officer of Health of Glasgow, was elected to the office. The Division wish to record their appreciation of the work done by Mr. Beaton during his period of office.

The 55th Annual Winter Session of the classes for firemen, boiler attendants, engineers, etc., organised by the Division, in conjunction with the Health Department of the Corporation of Glasgow, commenced in October and attendances, while not as high as last year, continue to be encouraging.

The Division are perturbed about the high cost of smokeless fuel in Scotland and also about the apparent scarcity of certain types of solid fuel. However, representations are being made in an attempt to remedy the situation and it is hoped that the position will improve in the near future.

F. J. FEELEY, A.C.I.S.,
Hon. Secretary.

Yorkshire Division

The year 1970 has been a busy one for the Yorkshire Division. The Divisional Council met on five occasions and there were three Open meetings including the Annual General Meeting.

Mr. James Goodfellow, Honorary Secretary of the Yorkshire Division since its inception in 1946 and Chief Public Health Inspector of the City of Leeds retired both as Chief Inspector for Leeds and as Honorary Secretary to the Division after the Annual General Meeting on the 25th March, 1970. At the inception of the Yorkshire Division in 1946 Mr. Goodfellow was nominated Acting Honorary Secretary and convened and advised the meeting that drafted the rules and constitution for the Divisional Council which were adopted at a meeting of the Yorkshire members of the National Smoke Abatement Society held in Leeds in September, 1947. Mr. Goodfellow represented the Yorkshire Division on the National Executive Council since that date to his retirement and was Chairman of the National Executive Council for the years 1964-1967. That the Yorkshire Division has been eminently successful has been largely due to Mr. Goodfellow's energy and his constant adherence to a policy of creating and promoting by publicity an informed public opinion on the value and importance of clean air. Mr. Goodfellow was succeeded as Honorary Secretary by Mr. J. H. Wyatt, who also succeeded him to the post of Chief Public Health Inspector of the City of Leeds.

The Annual General meeting of the Yorkshire Division was held in the Council Chamber of the Civic Hall, Leeds, on Wednesday, 25th March, 1970. The business of the meeting was formal but we were privileged to have a short and extempore address by the Director of the Society who attended the Annual Meeting of the Yorkshire Division for the first time. The meeting concluded with a presentation to the Honorary Secretary on behalf of the Divisional Council and other members of the Yorkshire Division to mark his retirement from office.

The first meeting of the Yorkshire Division in 1970 was an Open meeting held jointly with the West Riding Clean Air Advisory Council in the Leeds Civic Hall on the 14th January. The 120 members attending heard a paper entitled "Problems involved in the Implementation of the Clean Air Act, 1968" given by Mr. A. W. Perry, D.P.A., M.R.S.H., M.A.P.H.I., the Chief Public Health Inspector of the County Borough of Halifax. This was followed by an animated discussion on the points made by Mr. Perry.

On the 25th March, 1970, the Divisional Council met in the morning before the Annual General Meeting. This meeting was convened to discuss business matters of the Division prior to the Annual Meeting.

On the 4th May, 1970, at the kind invitation of Messrs. G. W. B. Boilers Ltd. members of the Council met to see a wood waste burning boiler installed by G. W. B. Boilers for a firm who are joiners and builders. This installation was designed to burn either coal or wood waste, a notable feature being its virtually smokeless operation. Following this the Council held a business meeting at the Parkway Hotel, Leeds. After the Council meeting members adjourned to the premises of the Yorkshire Electricity Board where a working model of an electrode steam raising boiler was demonstrated. This was followed by an illustrated talk by Mr. R. Burton of G. W. B. Boilers Ltd. on the design and potential of the electrode boiler, the various applications of electrode boilers in industry, and, in particular, how they were being utilised by the electrical industry.

On the 22nd June, 1970, by the kind invitation of Professor J. M. Beer, Dipl. Ing., Ph.D., D.Sc. (Tech), the Council visited the Department of Fuel Technology and Chemical Engineering at the University of Sheffield. Members were taken on a conducted tour to see various research projects which were under way in the department, and the tour was preceded by a talk by Professor Beer on the work of his department with particular reference to those activities which had a bearing upon the problems of air pollution.

On the 1st October, 1970, the Yorkshire Division strayed beyond its boundaries and by courtesy of the East Midlands Gas Board paid a visit to the gas reforming plant at Ambergate in Derbyshire. This visit was open to all members of the Yorkshire Division who were most generously entertained to lunch by the Board prior to visiting the Ambergate works. 70 members attended. A brief meeting of the Divisional Council was also held prior to the visit. The operation of the gas plant was explained in a talk by Mr. Higton, manager of the Works, prior to the conducted tour. The tour was of particular interest, because, in addition to gas production from light petroleum distillated by the I.C.I. lean gas steam reforming process, an opportunity was avilable to see arrangements for the storage of liquefied natural gas. An installation is provided here which has a capacity of 5,000 tons of liquefied natural gas stored at a temperature of minus 258°F. Members were particularly interested in this plant and the arrangements for the control of the "boil off" from the natural gas storage tank and the refrigeration required to reliquefy this "boil off" gas. At these works the liquefied gas is brought by road tanker from the Canvey Island terminal.

The final meeting of the year was held in the offices of the Leeds Public Health Department on the 17th November, 1970. This meeting was devoted to a discussion of domestic problems affecting the Division and matters which particularly concerned individual members of the Yorkshire Divisional Council. For instance a lengthy discussion took place about the Alkali &c Works Order and members voiced some dismay that the Alkali Inspectorate was to take over more work which was normally done quite properly by Local Authority Officers. Discussions were also held on the vexed subject of solid smokeless fuel shortages, and on the possibility of giving secondary grants to houses fitted with inset open fires in Smoke Control Areas declared before August 1964.

The year has been busy and interesting and progress in the Division by local authorities in the "black areas" in making Smoke Control Orders has continued, but this progress may well be prejudiced by possible solid smokeless fuel shortages during the Winter of 1970/71. Organisations such as this Society, and its members, who are concerned about the rate of progress in cleaning up the air in this country, must more than ever continue to exert pressure and to attempt to influence public opinion so as to speed up the process of cleaning the atmosphere.

W. H. WYATT.
Hon. Secretary.

West Midlands Division

During 1970 two well attended general meetings of the Division were held. The first, in April, which coincided with the Annual General Meeting, took the form of a visit to the Bolsover Works of Coalite and Chemical Products Ltd., Chesterfield. The firm had organised the visit extremely well, members being split up into small parties and taken round the works by most experienced guides. This was followed by a meeting in the lecture theatre where suitable films were shown. Members were then entertained to lunch at the kind invitation of Coalite Limited. After the Annual General Meeting a panel of Coalite personnel was available to answer members' questions; this afforded an excellent opportunity for local authority members in particular to put questions on the present solid smokeless fuel supply position, from which it was apparent that this particular firm were taking all possible measures to ensure an adequate supply of solid smokeless fuel.

In September a very interesting meeting took place at the Coalville Brickworks; this afforded members an opportunity to see the application of L.P.G. to brick manufacture. A detailed account of this visit appeared in the Winter Edition of "Smokeless Air".

Items considered by the Divisional Council during the year were the problems of noise from grit and dust measuring equipment; legal cases taken under the Clean Air Act, 1968; the question of the shortage of solid smokeless fuels and the conference programme.

W. L. KAY,
Hon. Secretary.

East Midlands Division

There has been no lack of enthusiasm on the part of the members of the East Midlands Division during 1970, as shown by the support given to the three meetings held, where the average attendance has been sixty-six. It is to be regretted, however, that it has not been possible to translate a larger measure of this enthusiasm into practical achievement by the expansion of smoke control, not only in the Division but in the country generally, due to the shortage of smokeless fuels. It is sad to relate that due to local shortages in the North of the Division during last winter a number of Smoke Control Orders which had been in operation for a number of years had to be temporarily suspended, the suspension being lifted at the end of April, 1970. It is pleasing to report, however, that so far during the current winter it has not been necessary to take such action.

The first of the Meetings of the Division was held at the Gas Reforming Plant of the East Midlands Gas Board at Ambergate on the 16th April, 1970, sixty-four members attending. This extensive plant which covers an area of approximately fourty-four acres was developed by the Gas Board to meet the rapid increasing demand for gas in the East Midlands Area, by non-traditional methods, and development took place before it was established that workable quantities of natural gas existed in the North Sea off the East Coast. Its purpose was to give a degree of independence from the coal industry, the Reforming Plant being designed to use either a light petroleum distillate or natural gas. The petroleum distillate is brought to the works by road tanker and stored in two 8,000 ton cylindrical tanks from which it is fed into four identical streams of gas making plant, capable of producing 135 million cubic feet of towns gas per day.

A section of the plant is set aside to receive and process liquefied natural gas which might safeguard supplies to the National Grid at peak periods. The liquefied natural gas is brought to the plant from the Gas Council terminal at Canvey Island, and is stored in an insulated tank with a capacity of 5,000 tons—the storage temperature being $-258°$F. Members were impressed when walking round the works by a complete absence of the smells usually associated with gas making, and it was of interest to learn that the gas produced at this plant had to be odorised to meet statutory requirements before distribution. After a tour of the works, members were entertained to luncheon at the Court Barbecue Restaurant, Allestree, at the kind invitation of the East Midlands Gas Board.

The afternoon session was devoted to a talk by L. W. Jarrett, Esq., the Divisional Commercial Manager of the East Midlands Gas Board, his subject being "North Sea Gas Utilisation and Conversion Strategy". In his address Mr. Jarrett dispelled many of the fears which have been expressed concerning the long term availability of natural gas from the North Sea and answered much of the adverse publicity levelled against the conversion programme and use of this new form of heat in the domestic field. He referred to the undertaking as the biggest "crash-programme" ever attempted and stated that while it was inevitable that some problems and difficulties would occur these were relatively small compared with the size of the undertaking.

The Annual General Meeting was held at the Miners' Community Centre, Snibston Colliery, Coalville on 9th July, 1970, at the invitation of the National Coal Board, under the chairmanship of Cllr. J. H. Gregory, Southwell R.D.C. seventy members attending. The officers elected for the ensuing year were as follows:—
Chairman—A. Wade, Esq., M.B.E. Deputy Chairman—Cllr. C. E. Holland. Honorary Secretary—Mr. G. Drabble (re-elected).

Following the business meeting, a film, produced for the National Carbonisation Company entitled "Breathing without Tears", which described the manufacture of Rexco and demonstrated the contribution that Company is making to the cause of Clean Air. At the end of the morning session members were entertained to an excellent buffet lunch at the kind invitation of the National Coal Board.

The afternoon Session was devoted to a study of, and visit to the City of Leicester District Heating Scheme at the Rowlatts Hill Estate. The scheme was explained by Mr. J. Ramsdale, the Technical Adviser of the National Coal Board. This complex of 507 dwellings, together with shops, an old people's home and a Children's Home, being heated from a central source using an indigenous fuel.

Mr. Gregson, the Deputy Housing Manager, welcomed the members on behalf of the Leicester Housing Department and explained the aims and objects of this Development and the different types of dwellings erected on the estate. Following the showing of an excellent film of the Rowlatts Hill Development a tour was made of the 20 acre estate, particular interest being shown in the heating system, the boiler being constructed partly below ground and the chimney flue forming an integral part of a 24 storey tower block. Members were given an opportunity of visiting a representative number of dwellings to obtain the tenants reactions to this type of heating, which were almost without exception, favourable.

On the 8th October, 1970, the Division visited the Coal Utilisation Council Heating Centre at St. Peters Gate, Nottingham at the invitation of the Council, sixty-two members attending. Members were welcomed by Mr. E. Wright the Regional Manager of the C.U.C. who explained his organisation and the services operated from the Centre which fell under three main headings:

(1) Service to the building and plumbing trades both in advisory capacity and by conducting practical instruction courses for operatives to qualify as Authorised Heating Appliance Fixers.
(2) Conducting Courses for Technical Officers of Local Authorities i.e. Public Health Inspectors and Housing Managers, in the theory and practice of Appliance Installation.
(3) Advice to the General Public in connection with Smoke Control Areas and assisting with problems encountered in such areas.

Mr. R. A. Johnson, Technical Training Officer was then introduced by Mr. Wright who enlarged on the Training Courses undertaken at the Centre and later dealt with questions raised by members.

A film entitled "Devil of a Story" which demonstrated the manufacture and installation of Domestic Solid Fuel Appliances was shown and this was followed by a conducted tour of the Training Centre and the Showrooms where Domestic Heating Appliances of all types were on display. At the close of the Morning Session members were entertained to lunch by the C.U.C.

The Afternoon Session opened with an interesting address by Mr. Attenborough the Senior Technical Instructor of the C.U.C. from the London Office, his subject being "The Development of the Domestic Solid Fuel Appliance". This was followed by Question Time when a panel of four composed of Mr. E. Wright, Centre Manager, Mr. Brown, his Deputy, Mr. R. A. Johnson and Mr. H. B. Dunstan, Head of Domestic Sales Branch, N.C.B. Midland Region undertook to answer members' questions on the subjects raised during the day and on the wider issues of fuel supplies and distribution.

G. DRABBLE,
Hon. Secretary.

South East Division

During the year three meetings of the Divisional Council were held, a General Meeting, when the subject was Solid Smokeless Fuels and which has already been reported upon. The Annual Meeting held on 10th December was followed by a talk given by Mr. H. Brown from the London Office of N.I.F.E.S., who stepped in at very short notice for Mr. W. Short, Area Manager of the North Western Region of N.I.F.E.S., who was delayed through transport difficulties. A full report of the meeting is published in the Spring edition of "Clean Air" but, briefly, Mr. Brown talked on three alternatives to simple controlled tipping, namely, (a) Pulverisation, (b) Composting, and (c) Incineration; the economics of the three methods, and illustrated them with slides of incineration plants in Denmark, Germany, Holland and Switzerland. Emphasis was given to the fact that large quantities of heat can be extracted from flue gases of an incinerator. At the conclusion of the talk many relevant questions were asked and Mr. Brown and his colleagues answered them fully.

The Annual election for members on the Divisional Council showed that representatives of the fuel industries, two being women's organisations, were not elected and the Committee, therefore, decided to co-opt those representatives in order to have a wider outlook on the Council.

Two visits were arranged, one to the Ford Motor Works and the other to Tilbury Electricity Generating Stations. The Division would again express thanks to the Ford Motor Company and the C.E.G. Board for arranging the visits and for the hospitality shown to members, and also to the staff who so capably acted as guides and instructors.

It is regretted that the visit to a Brick Works was not possible this year, nor to Edmonton Refuse Incinerator, but it is hoped that both these visits will be arranged for 1971.

On behalf of the Society talks were given on Clean Air as listed below and the Divisional Council are grateful to the persons concerned for having shown interest in this way. It must also be added that it is pleasing to see such a variety of organisations interested in Clean Air.

Weybridge Tc. H.	Mr. S. A. Eade, Chief Public Health Inspector, Walton Weybridge.
Homemakers Ladies Club, Harlow.	Mr. H. L. Hughes, Chief Public Health Inspector, Harlow.
Enfield Branch Nature Cure Society Symposium at Southgate Technical College.	Mr. J. C. Lightfoot, Chief Public Health Inspector.
Sidcup Eighteen Group	Mr. P. R. Hickson, Chief Public Health Inspector, Bexley.
Weston Green Young Conservatives, Esher.	Mr. C. Parkham, Deputy Chief Public Health Inspector, Esher.

R. F. SHAPTER
Hon. Secretary.

North West Division

The Annual General Meeting of the North West Division was held at the Belgrade Hotel, Dialstone Lane, Offerton, Stockport, on Tuesday, 21st April, 1970. Members were entertained to luncheon by the North West Gas Board and after lunch listened to a very interesting technical paper entitled "An Examination of Current Practice and Trends in the Disposal of Waste and Refuse" with an emphasis on incineration at source given by Mr. John R. Teale, C. Eng., F.I. Gas. E., Assoc. Inst. F.

The Divisional Council met on four occasions during the year; at the first meeting Mr. Winder, Chief Public Health Inspector of Stockport County Borough Council was elected Chairman of the Division for the year. Mr. R. W. Hollingdale of the North West Gas Board was elected Vice Chairman, Mr. H. Clusky was elected Honorary Treasurer, and Mr. W. E. Pollitt was elected Honorary Secretary.

The work of the Divisional Council has been mainly concerned with availability of supply of solid smokeless fuels and promoting the North West Division's Clean Air Competition.

The shortage of supplies of solid fuel was of such concern to the Divisional Council that a resolution in three parts dealing with designation of solid fuel appliances, the provision of a second grant to owners, etc., who wished to change to a piped supply of smokeless fuel and a request to suspend the closure of coke producing Gas Works was sent to the Executive Council in London for action. This resolution was supported by the whole of the Division at its Annual General Meeting. The Executive Council however, despite the forceful manner in which the situation was explained, failed to support the proposition.

As a result many Local Authorities have suspended their Pre-1964 Smoke Control Orders; this is to be regretted, and it is to be wondered if, when the summer months arrive and all these Local Authorities wish to revoke their suspensions, there will be sufficient supply to meet the immediate heavy demand—or if the Minister of the Environment will stagger or phase the operation.

The Clean Air Competition took up a great deal of the time of the Honorary Secretary and only the fact that he was ably assisted by the Chairman and Vice Chairman and all our friends in the fuel Industries was the competition completed in time. 500,000 entry forms were printed and distributed throughout the Division, 1,764 entries being returned. The publicity experts state that this was a fair return.

In addition to this work of the Division, speakers were again provided to Schools, Technical Colleges and other organisations.

The request for information on atmospheric pollution from students of all kinds is on the increase. It is time that the Universities, Colleges and Schools were encouraged to join the Society as there is a source of untapped revenue for the Society in this field.

While the Clean Air Movement may have suffered a set-back because of the shortage of solid smokeless fuel, we must perhaps take a short breath and resume our fight for a cleaner environment with renewed and greater vigour—thus achieving the rightful heritage of every person.

A meeting of all the Members of the North West Division was held at the Headquarters of the Merseyside and North Wales Electricity Board at Chester when Members were entertained to lunch and were able to inspect the Headquarters.

It was with regret that we learned of the death of Miss N. Kenyon and Mr. J. Rodgers both of whom had for many years been staunch and energetic members of the Division. Their wisdom, wit and ready assistance and energy in the field of clean air will be greatly missed.

W. E. POLLITT,
Hon. Secretary.

North East Division

The usual two meetings were held during the year of which the main event was the Annual Meeting held in April at Norgas House, Killingworth, Northumberland.

On this occasion, a symposium was presented by representatives of the Northern Gas Board, who dealt with all aspects of the application of North Sea gas in the domestic field. Delegates were later taken by helicopter on an aerial survey of air pollution over the Tyneside area.

During the course of the business meeting, references were inevitably made to the difficulties of the fuel situation, and the Honorary Secretary made special reference to the anxiety expressed by residents in the Tyne Valley over the possibility of air pollution arising from a pulp mill which it was proposed to establish in that area.

I am happy to report that since that Annual Meeting, no further steps seem to have been taken to pursue this proposal.

Towards the end of September, 1970, a second meeting was held at the National Coal Board Offices, Gateshead, Co. Durham. This meeting had been called specially to discuss the position of solid fuel in the North East, and the Deputy Regional Marketing Director of the Northern Sales Region of the National Coal Board, delivered a forthright and comprehensive address on this subject. A most lively discussion ensued, which resulted in a resolution being sent to the Director of the Society for consideration by the Executive Council. Various views were expressed and circumstances and situations recounted, outlining the need for a National Fuel Policy for Clean Air, extensive references to which have been made in the official journal "Clean Air". As is now known, this resolution was eventually submitted to the National Conference of the Society in Southport in October, 1970, when it was carried by an overwhelming majority.

Throughout the year I receive assistance from numerous sources in the pursuit of information on behalf of the Society. I am most grateful for this assistance so readily given, particularly by the Chief Public Health Inspectors of North East authorities who have been particularly patient with my persistent enquiries. The local press too, have always been ready to lend support to the clean air movement, and the friendly co-operation of their local representatives is appreciated.

L. MAIR,
Hon. Secretary.

South West Division

Two meetings of the South West Division were held during the year, one at the Guildhall, Bath and the other at the Central Electricity Generating Board at Portishead.

The meeting at Bath was held in July 1970 and the main item was a paper entitled "The New Waste Problem and its Consequences", by Mr. John Lewis, a Lecturer in the Department of Civil Engineering of the Brighton Polytechnic. Details of this paper have already been reported in "Smokeless Air", and suffice it to say that the paper was a very stimulating one and a lively discussion followed. The speaker and officers of the South West Division were entertained to lunch by the Mayor of Bath, Councillor W. Huggett.

The second meeting was held at the Central Electricity Generating Board Power Station, Portishead, near Bristol in November, 1970. Although the meeting was held at a Power Station its purpose was not to study electricity generation, but to see the work being carried out in the Environmental Section of the Scientific Services Department, South West Region, Central Electricity Generating Board. This was in line with the policy of the Divisional Council of widening the scope of our activities to include all forms of environmental pollution. After its meeting in the morning the Divisional Council was entertained to lunch by the Central Electricity Generating Board at the Bay Hotel, Portishead. After a short business meeting in the afternoon, Mr. R. T. Jarman, the Environmental Section Head, gave a short talk on the work of the Scientific Services Department. This was followed by a tour of the laboratories, with demonstrations of clean air meters, the problem of thermal water pollution, noise, pulverised fuel ash utilisation, and the ventilation of power station boiler houses.

During the year, members of the Divisional Council expressed concern at the inadequacy of Section 6 of the Clean Air Act, 1968 in dealing with existing chimneys where emission is increased without any increase in combustion space. This was brought to the attention of the Legal and Parliamentary Committee who were not convinced that a problem existed. However, the preliminary results of a survey of all the Divisions indicated that we in the South West are not alone in experiencing difficulties in the enforcement of this Section.

Once again the South West Division sent a delegate, Mr. Philip Draper, to the National Conference at Southport. Mr. Draper also represented both the Division and the National Society at a short course on "The Fundamentals of Engine Exhaust Pollution" at the University of Leeds.

Unfortunately, the Annual General Meeting which was to have been held in March, 1971 had to be postponed as adequate notice could not be given due to the postal strike. This will now be held in June.

G. J. CREECH,
Honorary Secretary.

South Wales Division

During 1970 one meeting was held on the 17th of November. The meeting took the form of a lecture and visit to the British Steel Corporation, Strip Mills Division, Port Talbot Works.

Following last year's visit to the Llanwern Steel Works and their method of steel production, this visit was arranged to show the latest method of steel making in the country by use of the B.O.S. Plant.

On arriving at the works, the 50 members present were addressed by a senior member of the staff on the method of steel making incorporated at Port Talbot and the system of gas cleaning used.

Following the lecture, members were toured to the new harbour which had been recently opened and enables ore boats of one hundred thousand tons to be discharged. This was followed by a visit to the B.O.S. Plant itself. Members were guided by the staff and shown, after a slight delay, the convertors in use. This system of steel making with its gas scrubbing has eliminated the plume of red oxide dust to be seen previously at Port Talbot from the V.L.N. Plant.

The Company then very kindly provided refreshments for members and the thanks of the Division were accorded to Mr. Locke, the Company Secretary, for his arrangements of the meeting by Alderman J. Warren, National Executive Member. Mr. Locke suitably replied.

L. MORGAN
Hon. Secretary

TRADE DIRECTORY AND BUYERS' GUIDE

page
Adjustable Roof Plate (PVC and Polypropylene) ... 86
Air Conditioners (Domestic) ... 86
Air Conditioning Equipment ... 86
Air Pollution Measurement ... 86
Anti-Soot and Corrosion Treatment ... 86
Automatic Control Equipment ... 86

Bacteria Sampling Equipment ... 86
Bifurcated Fans (PVC and Polypropylene) ... 86
Boilers, Domestic ... 86
Boilers, Industrial ... 86
Boilers, Industrial (Solid Fuel) ... 86
Boilers, Industrial (Waste-Fired) ... 86
Boilers, Packaged (Oil-Fired) ... 86
Boiler Tube Cleaning Equipment ... 86
Brushes (Tube) ... 86
Burners, Gas ... 87
Burners, Oil ... 87
Burners, Solid Fuels ... 87

Canopy Hood ... 87
Central Heating Systems ... 87
Centrifugal Fans ... 87
Chimneys ... 87
Chimneys Cladding (Aluminium) ... 87
Chimneys (Insulated) ... 87
Chimney Linings ... 87
Clean Rooms ... 87
Coal Handling Plant ... 87
Contractors, Heating, Ventilating & Air Conditioning 87
Controlled Draught Regulators ... 87
Coolers ... 87

Dampers, Gas-Tight ... 88
Dehumidifiers ... 88
Discharge Valves ... 88
Ducting ... 88
Dust Classification Plant ... 88
Dust Collecting Equipment & Plant ... 88
Dust Collector Filter Media ... 88
Dust Sampling Equipment ... 89
Dust Suppression Equipment ... 89

Economisers Fuel ... 89
Electrical Precipitators ... 89
Electric Vehicles ... 89

Fabric Filters ... 89
Fans ... 89
Filter Paper ... 89
Filters, Air ... 89
Filters, Dust ... 89
Flue Dust Extraction Plant ... 89
Flue Gas Dust Monitoring Device (C.E.G.B. Type) ... 90
Flue Gas Dust Sampling Equipment (B.C.U.R.A. Type) 90
Flue Gas Treatment ... 90
Fuel Additives ... 90
Fuel efficiency Advisory Service ... 90
Fuel - Electricity Supply ... 90
Fuel - Gas ... 90
Fuel - Gas (L.P.G.) ... 90
Fuel Oil Combustion Improver ... 90
Fuel Oil Conditioner ... 90
Fuel Oil (Domestic and Industrial Oil Fuels) ... 90
Fuels-Solid Smokeless ... 90
Fume Removal Equipment ... 90
Furnaces, Ovens, Kilns, etc. ... 91

page
Gas Cleaning Plant ... 91
Gas Heating Equipment ... 91
Gas Scrubbers & Washers ... 91
Grit Arresters ... 91

Heat Exchangers ... 92
Heaters, Air ... 92
Heating Equipment, Industrial (Process Space) ... 92
Heating Systems - Electric ... 92
Heating Systems - Oil ... 92
Humidifiers ... 92

Incandescent/Whiting Wet Arrester for Cupolas ... 92
Incinerators ... 92
Indicators, Humidity ... 92
Instruments, Gauges, Meters, etc. ... 92

Laboratory Fume Cabinets ... 92
Lecture, Filmstrips & Notes ... 93

Odour Control ... 93

Perforated Metal ... 93
Pumps ... 93

Radiant Heating ... 93
Refrigeration Plant ... 93
Research and Development Facilities ... 93
Roof Ventilators (P.V.C.) ... 93
Room Heaters—Gas ... 93

Smoke Density Gauges & Meters ... 93
Smoke Density Telescopes ... 93
Smoke Indicators ... 93
Steam Condenser Unit (Polypropylene) ... 93
Stokers, Industrial ... 93

Tanks and Tank Linings ... 93
Thermal Storage Systems ... 93
Thermometers, Indicators, etc. ... 93
Thermostatic Radiator Valves ... 93
Tube Cleaning Machines ... 93
Tube Cleaning Tools & Brushes ... 94

Unit Dust Collectors ... 94

Ventilators ... 94

Warm Air Heating Systems ... 94
Waste Heat Recovery ... 94
Waste Material Disposal Furnaces ... 94
Wet Arresters ... 94
Wire Brushes (Tube and Surface) ... 94

ENQUIRIES FOR ADVERTISING SPACE

Advertisement Manager, National Society for Clean Air, 134-137 North Street, Brighton BN1 1RG. Tel: Brighton 26313

RATES:

First entry under classified heading, £2; branch addresses £1 each, extra.

Second and further entries under other headings £1 each and 50p per branch address.

ADJUSTABLE ROOF PLATE (PVC AND POLYPROPYLENE)

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs. WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

AIR CONDITONERS (DOMESTIC)

Felvic Industries
21 Napier Road, Bromley BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

John Bass Ltd.
BMB Works, Fleming Way, Crawley, Sussex (28765) (Telex 87153).

AIR CONDITIONING EQUIPMENT

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs. WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

Aeronca International Ltd.
Berkshire House, Maidenhead, Berkshire, (Maidenhead 30311).
Penarth Road, Cardiff CF1 7UG (Cardiff 37873).
334 Wellington Road North, Stockport, Cheshire (Heaton Moor 8025).

Felvic Industries
21 Napier Road, Bromley BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

Air Movement Ltd.
Dover Road, Northfleet, Kent. (Gravesend 64844).

Spencer and Halstead Ltd.
Ossett, Yorkshire (Ossett 5121).
84 High Street, Cradley Heath, Warley, Worcs. (Cradley Heath 67031).
Spenstead House, Ashley Road, Epsom (Epsom 27101) (*"Spenstead"*).

Morgan Air Treatments Ltd.
Darwin Street, Birmingham 12 (021-772 2096 & 1309).

Morgan Air (Scotland) Ltd.
208 Bath Street, Glasgow, C.2 (041 DOU 3611/2/3/4) (*Morganair*).

Paracon Department, Thermotank Products,
A division of Hall-Thermotank International Ltd., Airedale Mills, Rodley, Leeds LS13 1JZ (Pudsey 71521/4).

John Bass Ltd.
BMB Works, Fleming Way, Crawley, Sussex. (28765) (Telex 87153)

AIR POLLUTION MEASUREMENT

Photoelectronics (Arcall) Ltd.
Arcall House, Restmore Way, Hackbridge, Surrey (01-669 0966) (*M.O.M.*).

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts. (3101-5) (Telex 82385).

C.F. Casella & Co. Ltd.
Regent House, Britannia Walk, London, N.1 (01-253 8581).

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Surrey (Byfleet 43224) (*Pumps*).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham 3 (021-236 3388).
Simon House, 28-29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant and service*).

ANTI-SOOT AND CORROSION TREATMENT

Cyril G. Henson, F.I.Plant E., F.I.E.I., M.S.M.
"Overmead" Blackberry Road, Lingfield, Surrey (0342-87 297) (24-hour telephone answering service).
United Kingdom Representative for "Rolfite"—an advanced combustion technology.

Polar Industrial Chemicals Ltd.
34 Ebury Street, London, S.W.1 (01-730 7158) (*Panorin*).

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 3871) (*Tri-Ad*).

AUTOMATIC CONTROL EQUIPMENT

Photoelectronics (Arcall) Ltd.
Arcall House, Restmore Way, Hackbridge, Surrey (01-669 0966) (*M.O.M.*).

Felvic Industries
21 Napier Road, Bromley BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201) (Telex 261076).
Works: Hoval Farrar Boilers Ltd. Newark-On-Trent, Notts. (*Hoval/Biral*).

BACTERIA SAMPLING EQUIPMENT

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London, N.1 (01-253 8581).

BIFURCATED FANS (PVC AND POLYPROPYLENE)

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs. WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

BOILERS, DOMESTIC

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201) (Telex 261076).
Works: Hoval Farrar Boilers Ltd., Newark-On-Trent, Notts. (*Hoval/Biral*).

BOILERS, INDUSTRIAL

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201) (Telex 261076).
Works: Hoval Farrar Boilers Ltd., Newark-On-Trent, Notts. (*Hoval/Biral*).

Hamworthy Engineering Ltd.
Fleets Corner, Poole, Dorset (Poole 5123) (*Burners and Boilers*).

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

BOILERS, INDUSTRIAL (SOLID FUEL)

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

BOILERS, INDUSTRIAL (WASTE-FIRED)

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

BOILERS, PACKAGED (OIL-FIRED)

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

Hamworthy Engineering Ltd.
Fleets Corner, Poole, Dorset (Poole 5123) (*Burners and Boilers*).

Auto Combustions (London) Ltd.
360-364 Wandsworth Road, London, S.W.8 (01-622 9121) (*A.C.L. Range of Oil-Fired Boilers*).

BOILER TUBE CLEANING EQUIPMENT

Rotatools (U.K.) Ltd.
Pembroke Works, 43-45 Pembroke Place, Liverpool L3 5PH (051-709 6117).

BRUSHES (TUBE)

Rotatools (U.K.) Ltd.
Pembroke Works, 43-45 Pembroke Place, Liverpool L3 5PH (051-709 6117).

Peabody Ltd.
35 Clapham Park Road, London, S.W.4 (01-622 4311/7).

Hamworthy Engineering Ltd.
Fleets Corner, Poole, Dorset (Poole 5123) (*Burners and Boilers*).

BURNERS, GAS

Auto Combustions (London) Ltd.
360-364 Wandsworth Road, London, S.W.8 (01-622 9121) (*Swirlamiser Gas Burners*).

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

BURNERS, OIL

Peabody Ltd.
35 Clapham Park Road, London, S.W.4 (01-622 4311/7).

Hamworthy Engineering Ltd.
Fleets Corner, Poole, Dorset (Poole 5123) (*Burners and Boilers*).

Auto Combustions (London) Ltd.
360-364 Wandsworth Road, London, S.W.8 (01-622 9121) (*Swirlamiser and Autoflame Oil Burners*).

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

BURNERS, SOLID FUEL

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London W1P 5AD (01-388 0331).

CANOPY HOOD

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs. WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

CENTRAL HEATING SYSTEMS

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201) (Telex 261076).
Works: Hoval Farrar Boilers Ltd., Newark-on-Trent, Notts. (*Hoval/Biral*).

CENTRIFUGAL FANS (PVC AND POLYPROPYLENE)

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs. WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

CHIMNEYS

F. E. Beaumont Ltd.
Rathgar Road, London, S.W.9 (01-274 4066).
Woodlands Road, Mere, Warminster, Wiltshire (0747-86 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021-552 2039).

Steel Chimneys Ltd.
New Hall Works, Lower Edge Road, Elland (Elland 2431).

Thermotank Products
A Division of Hall-Thermotank International Ltd., 150 Helen Street, Glasgow, S.W.1 (Govan 2444) (*Dribore*).

CHIMNEYS (INSULATED)

Thermotank Products
A division of Hall-Thermotank International Ltd., 150 Helen Street, Glasgow, S.W.1 (041-445 2444).
232–242 Vauxhall Bridge Road, London (*Dri-bore chimneys*).

F. E. Beaumont Ltd.
Rathgar Road, London, S.W.9 (01-274 4066).
Woodlands Road, Mere, Warminster, Wiltshire (0747 86 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021 552 2039).

CHIMNEY CLADDING (ALUMINIUM)

F. E. Beaumont Ltd.
Rathgar Road, London, S.W.9 (01-274 4066).
Woodlands Road, Mere, Warminster, Wilts. (0747 86 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021 552 2039).

Steel Chimneys Ltd.
New Hall Works, Lower Edge Road, Elland (Elland 2431).

CHIMNEY LININGS

McFarlane—Walls Ltd.
192–194 London Road, Kingston upon Thames, Surrey (01-549 0801) (*Supaflu Chimney Linings*).

Supaflu
192–194 London Road, Kingston upon Thames, Surrey (01-549 0801) (*Chimney Lining Systems*).

CLEAN ROOMS

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864 0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772 5102/3).

Air Movement Ltd.
Dover Road, Northfleet, Kent. (Gravesend 64844).

John Bass Ltd.
BMB Works, Fleming Way, Crawley, Sussex. (28765) (Telex 87153)

COAL HANDLING PLANT

Buell Ltd.
George Street Parade, Birmingham 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

CONTRACTORS, HEATING, VENTILATING & AIR CONDITIONING

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864 0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772 5102/3).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

Morgan Air Treatments Ltd.
Darwin Street, Birmingham 12 (021-772 2096 & 1309).

Morgan Air (Scotland) Ltd.
208 Bath Street, Glasgow, C.2 (041-DOU 3611/2/3/4) (*Morganair*).

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs., WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

CONTROLLED DRAUGHT REGULATORS

Metro-Flex Group of Companies
Metro-Flex Works, Earl Road, London, S.E.1 (01-237 8241) (*Metro-Flex*).

COOLERS

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01- 460 1117) (Telex 896501) (*Humidity & Temperature Control*).

Buell Ltd.
George Street Parade, Birmingham 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

DAMPERS, GAS-TIGHT

Metro-Flex Group of Companies
Metro-Flex Works, Earl Road, London, S.E.1 (01-237 8241) (*Metro-Flex*).

DEHUMIDIFIERS

Heather Filters Ltd.
Rosemount Towers, Wallington, Surrey (01-647 2071) (*Humexair*).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

DISCHARGE VALVES

Buell Ltd.
George Street Parade, Birmingham 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant and Services*).

DUCTING

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs., WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

Wright & Summerhill Ltd.
Lupton Street, Leeds 10 (75434/5) (*Constructional Engineers, Sheet Metal, Ventilating & Light*).

Jo-For Engineering (Sheet Metal Works) Ltd.
76, 76a, 78 Dartford Industrial Estate, Powder Mill Lane, Dartford, Kent (Dartford 27571).

Morgan Air Treatments Ltd.
Darwin Street, Birmingham, 12 (021-772 2096 and 1309).

Morgan Air (Scotland) Ltd.
208 Bath Street, Glasgow, C.2 (041-DOU 3611/2/3/4) (*Morganair*).

DUST COLLECTION EQUIPMENT & PLANT

Aeronca International Ltd.
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).
Penarth Road, Cardiff, CF1 7UG (Cardiff 37873).
334 Wellington Road North, Stockport, Cheshire (Heaton Moor 8025).

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864 0288).
Devonshire House, High Street, Deritend, Birmingham, 12 (021-772 5102/3).

Mikropul Ltd.
Towerfield Industrial Estate, Shoeburyness, Essex, SS3 9QU (Shoeburyness 3511-3 and 2373-5, Telex 99346).

R. J. Richardson & Sons Ltd.
37 Commercial Street, Birmingham, 1 (021-643 2281) (P.B.X.).

Jo-For Engineering (Sheet Metal Works) Ltd.
Head Office & Works, Units 76, 76a, 78 Dartford Industrial Estate, Powder Mill Lane, Dartford, Kent (Dartford 27571).

Dust Suppression Limited
Bourne End Mills, Hemel Hempstead, Herts. (Berkhamsted 5522, Telex 825075 Chemjet Hemel).

Howden Engineering Limited
Godfrey House, Hampton Road West, Hanworth, Middlesex (01-898 1821, Telex 262370, Telegrams Godfrepart London).
195 Scotland St., Glasgow, C.5 (041-429 2131, Telex 77439, Telegrams Howden Glasgow).
14/16 Cockspur Street, London, S.W.1 (01-930 7177, Telex 25149, Telegrams Preheating London S.W.1).
2 St. John Street, Manchester, 3 (061-834 0181).

Ambuco Limited
Grosvenor House, 125 High Street, Croydon, CR0 1QJ (01-686 0411).

The Midland Heating & Ventilation Co. Ltd.
Bedford Road, Birmingham, 11 (021-772 3781).

Buell Limited
George Street Parade, Birmingham, 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

Nailsea Engineering Co. Ltd.
Samlesbury Airfield, Blackburn, Lancs. (Mellor 2166) (*Pnu-Jet dust filters and collectors*).

Dust Control Equipment Ltd.
Thurmaston, Leicester, LE4 8HP (Syston 0537-23 3333).

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928 4242).

Drummond Dust & Fume Extractors Ltd.
Gibson House, 800 High Road, Tottenham, N.17 (01-808 6466/8).

Airmaster Engineering Ltd.
Olympia Works, Roundhay Road, Leeds, LS8 4BH (Leeds 656494).

Chemical Construction (G.B.) Ltd.
Regal House, Twickenham, Middlesex (01-892 4455) (*P.A. & W.A. Venturi Scrubbers*).

Morgan Air Treatments Ltd.
Darwin Street, Birmingham, 12 (021-772 2096 & 1309).

Morgan Air (Scotland) Ltd.
208 Bath Street, Glasgow, C.2 (041-DOU 3611/2/3/4) (*Morganair*).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant and Services*).

Harvey Fabrication Ltd.
Woolwich Road, London, S.E.7 (01-858 3232) (*Harvey, Torit*).

Spencer & Halstead Ltd.
Ossett, Yorkshire (Ossett 5121).
84 High Street, Cradley Heath, Warley, Worcs. (Cradley Heath 67031).
Spenstead House, Ashley Road, Epsom (Epsom 27101) ("*Spenstead*").

Peabody Ltd.
35 Clapham Park Road, London, S.W.4 (01-622 4311-7).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Centri-Spray Ltd.
Green Dragon House, 64/70 High Street, Croydon, Surrey (01-688 7431).

Centri-Spray GmbH.
Lloyd Haus, Barbarossa Platz 4, Koln 5, West Germany.

Centri-Spray Sarl
125 Rue Anatole France, Noisy-Le-Sec 93, France.

DUST CLASSIFICATION PLANT

Buell Ltd.
George Street Parade, Birmingham, 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191).

DUST COLLECTOR FILTER MEDIA

Bury & Masco Industries Ltd.
Webron Division, Hareholme Works, Bacup Road, Rossendale, Lancashire, BB4 7LW (Rossendale (07-062) 4001).

DUST SAMPLING EQUIPMENT

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London, N.1 (01-253 8581).

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts. (Telex 82385 3101-5).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

DUST SUPPRESSION EQUIPMENT

Dust Suppression Ltd.
Bourne End Mills, Hemel Hempstead, Herts. (Berkhamsted 5522, Telex 825075 Chemjet Hemel).

ECONOMISERS-FUEL

Polar Industrial Chemicals Ltd.
34 Ebury Street, London, S.W.1 (01-730 7158) (*Panorin*).

Cyril G. Henson, F.I.Plant.E., F.I.E.I., M.S.M.
"Overmead", Blackberry Road, Lingfield, Surrey (0342-87 297) (24 hour answering service). United Kingdom Representative for "Rolfite"—an advanced combustion technology.

ELECTRICAL PRECIPITATORS

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby On Tees, Teesside (064 2 65572).

Bel Sound Products Co.
21 Greenfield, Ryde Estate, Hatfield, Herts. (Hatfield 62915) (*Crystalair*).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant & Services*).

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
364 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103–105 Pilgrim Street, Newcastle Upon Tyne, 1 (Newcastle 24401).
19–20 Elmdale Road, Bristol 8 (Bristol 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928 4242) (*Air Pollution Control Engineers*).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

ELECTRIC VEHICLES

Electric Vehicle Association of Great Britain
Trafalgar Buildings, 1 Charing Cross, London, S.W.1 (01-930 6757) (*On road & Off road Electric Vehicles*).

FABRIC FILTERS

John R. Carmichael Ltd.
Kenmore Works, Broad Lane, Liverpool, L11 1AE (051 STA 1336/7).

FANS

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs., WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

Edgar Allen Aerex Ltd.
P.O. Box 46, Imperial Steel Works, Sheffield S9 1QZ (Sheffield 49054). (Telex 54115).

Spencer & Halstead Ltd.
Ossett, Yorkshire (Ossett 5121).
84 High Street, Cradley Heath, Warley, Worcs. (Cradley Heath 67031).
Spenstead House, Ashley Road, Epsom (Epsom 27101) ("*Spenstead*").

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

The Midland Heating & Ventilation Co. Ltd.
Bedford Road, Birmingham, 11 (021-772 3781).

FILTERS, AIR

GKN Farr Filtration Ltd.
31–38 Moseley Street, Birmingham, 5 (021-643 7961).

Heather Filters Ltd.
Rosemount Towers, Wallington, Surrey (01-647 2071) (*Multi-Brush*).

Nailsea Engineering Co. Ltd.
Samlesbury Airfield, Blackburn, Lancs. (Mellor 2166). (*Pnu-Jet dust filters and collectors*).

Vokes Ltd.
Henley Park, Guildford, Surrey (Guildford 62861).
Salus Street, Burnley, Lancs. (*Air Filters and Air Filter Media.*)

Spencer & Halstead Ltd.
Ossett, Yorkshire (Ossett 5121). ("*Spenstead*").

The Midland Heating & Ventilation Co. Ltd.
Bedford Road, Birmingham, 11 (021-772 3781).

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
364 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103–105 Pilgrim Street, Newcastle-upon-Tyne (Newcastle 24401).
19–20 Elmdale Road, Bristol 8 (Bristo 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928 4242) (*Air Pollution Control Engineers*).

John Bass Ltd.
BMB Works, Fleming Way, Crawley, Sussex. (28765) (Telex 87153)

FILTERS, DUST

Dust Control Equipment Ltd.
Thurmaston, Leicester, LE4 8HP (Syston 0537-23 3333) (*Dalamatic*).

FILTER PAPER

Evans, Aldard & Co. Ltd.
Postlip Mills, Winchcombe, Cheltenham, Glos., GL54 5BB (024-260 227) (*Postlip Filter Paper*).

FLUE DUST EXTRACTION PLANT

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Middlesex (01-898 1821, Telex 262370, Telegrams Godfrepart London).
195 Scotland St., Glasgow, C.5 (041-429 2131, Telex 77439, Telegrams Howden Glasgow).
14/16 Cockspur St., London, S.W.1 (01-930 7177, Telex 25149, Telegrams Preheating London S.W.1).
2 St. John Street, Manchester, 3 (061-834 0181).

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby-on-Tees, Teesside (064 2 65572).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant & Services*).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

Buell Ltd.
George Street Parade, Birmingham, 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

Ambuco Limited
Grosvenor House, 125 High Street, Croydon, CR0 1QJ (01-686 0411).

FLUE GAS DUST MONITORING DEVICE (C.E.G.B. TYPE)

Photoelectronics (Arcall) Ltd.
Arcall House, Restmore Way, Hackbridge, Surrey (01-669 0966) (*M.O.M.*)

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

FLUE GAS DUST SAMPLING EQUIPMENT (B.C.U.R.A. TYPE)

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

FLUE GAS TREATMENT

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant and Services*).

Peabody Ltd.
35 Clapham Park Road, London, S.W.4 (01-622 4311/7).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, W.1 (01-839 6843).

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 3871) (*Dolomite/Magnesite*).

D.C.P. Systems Ltd.
Centre Heights, 137 Finchley Road, London, N.W.3 (01-586 1121).

Chemical Construction (G.B.) Ltd.
Regal House, Twickenham, Middx. (01-892 4455) (*P.A. & W.A. Venturi Scrubbers*).

Polar Industrial Chemicals Ltd.
34 Ebury Street, London, S.W.1 (01-730 7158) (*Panorin*).

FUEL ADDITIVES

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 3871) (*Alumag etc.*).

FUEL EFFICIENCY ADVISORY SERVICE

National Industrial Fuel Efficiency Service
Abford House, 15 Wilton Road, London, SW1V 1LZ (01-828 8241).

FUEL-ELECTRICITY SUPPLY

The Electricity Council
30 Millbank, London, S.W.1 (01-930 2333).
Marketing Dept.:
Trafalgar Buildings, 1 Charing Cross, London, S.W.1 (01-930 6757).

FUEL—GAS

The Gas Council
59 Bryanston Street, Marble Arch, London, W1A 2AZ (01-723 7030).

FUEL—GAS (L.P.G.)

Shell-Mex and B.P. Gases Ltd.
Shell-Mex House, Strand, London, W.C.2 (01-836 1234) (*Bottogas, Butane, Propagas, Propane*).

FUELS (SOLID SMOKELESS)

National Coal Board
Hobart House, Grosvenor Place, London, S.W.1 (01-235 2020).
Coal Products Division: Coal House, Lyon Road, Harrow, Middx. (01-427 9001) (*Homefire, Multiheat, Phurnacite, Roomheat, Sunbrite, Anthracite, Welsh Dry, Steam*).

National Carbonising Company Ltd.
Fullarton Lodge, Crow Hill Drive, Mansfield, Notts. (Mansfield 22357) Thorney House, 34.

FUEL OIL (DOMESTIC & INDUSTRIAL OIL FUELS)

Shell-Mex & B.P. Ltd.
Shell Mex House, Strand, London, W.C.2 (01-836 1234).

FUEL OIL COMBUSTION IMPROVER

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 3871) (*Tri-Tex*).

Cyril G. Henson, F.I.Plant.E., F.I.E.I., M.S.M.
"Overmead", Blackberry Road, Lingfield, Surrey (0342-87 297) (24 hour telephone answering service). United Kingdom representative for "Rolfite"—an advanced combustion technology.

FUEL OIL CONDITIONER

Cyril G. Henson, F.I.Plant.E., F.I.E.I., M.S.M.
"Overmead", Blackberry Road, Lingfield, Surrey (0342-87 297) (24 hour telephone answering service). United Kingdom representative for "Rolfite"—an advanced combustion technology.

FUME REMOVAL EQUIPMENT

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex HA2 0DY (01-864 0288).
Devonshire House, High Street, Deritend, Birmingham, 12 (021-772 5102/3).

Mikropul Ltd.
Towerfield Industrial Estate, Shoeburyness, Essex, SS3 9QU (Shoeburyness 3511-3 and 2373-5, Telex 99346).

R. J. Richardson & Sons Ltd.
37 Commercial Street, Birmingham, 1 (021-643 2281) (P.B.X.).

Buell Ltd.
George Street Parade, Birmingham, 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

The Midland Heating & Ventilation Co. Ltd.
Bedford Road, Birmingham, 11 (021-772 3781).

Ambuco Limited
Grosvenor House, 125 High Street, Croydon, CR0 1QJ (01-686 0411).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928 4242) (*Air Pollution Control Engineers*).

Drummond Dust & Fume Extractors Ltd.
Gibson House, 800 High Road, Tottenham, N.17 (01-808 6466/8).

Chemical Construction (G.B.) Ltd.
Regal House, Twickenham, Middlesex (01-892 4455) (*P.A. & W.A. Venturi Scrubbers*).

Morgan Air Treatments Ltd.
Darwin Street, Birmingham, 12 (021-772 209 & 1309).

Morgan Air (Scotland) Ltd.
208 Bath Street, Glasgow, C.2 (041-DOU 3611/2/3/4) (*Morganair*).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant and Services*).

Harvey Fabrication Ltd.
Woolwich Road, London, S.E.7 (01-858 3232) (*Harvey, Torit*).

Spencer & Halstead Ltd.
Ossett, Yorkshire (Ossett 5121) (*Buell Industrial Drying dust Collection and Powder Classification Plants*).

Peabody Ltd.
35 Clapham Park Road, London, S.W.4 (01-622 4311/7).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Centri-Spray Ltd.
Green Dragon House, 64–70 High Street, Croydon, Surrey (01-688 7431).

Centri-Spray GmbH
Lloyd Haus, Barbarossa Platz 4, Koln 5, West Germany.

Centri-Spray Sarl
125 Rue Anatole France, Noisy-Le-Sec 93, France.

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby-on-Tees, Teesside, England (064 2 65572).

FURNACES, KILNS, OVENS, ETC.

R. M. Catterson-Smith Ltd.
Woodrolfe Road, Tollesbury, Essex (Tollesbury 342) (*Electric Furnaces*).

GAS CLEANING PLANT

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Middlesex (01-898 1821, Telex 262370, Telegrams Godfrepart London).
195 Scotland Street, Glasgow, C.5 (041-429 2131, Telex 77439, Telegrams Howden Glasgow).
14/16 Cockspur Street, London, S.W.1 (01-930 7177, Telex 25149, Telegrams Preheating London S.W.1).
2 St. John Street, Manchester, 3 (061-834 0181).

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby-on-Tees, Teesside (064 2 65572).

Centri-Spray Ltd.
Green Dragon House, 64–70 High Street, Croydon, Surrey (01-688 7431).

Centri-Spray GmbH
Lloyd Haus, Barbarossa Platz 4, Koln 5, West Germany.

Centri-Spray Sarl
125 Rue Anatole France, Noisy-Le-Sec 93, France.

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

Peabody Ltd.
35 Clapham Park Road, London, S.W.4 (01-622 4311/7).

Chemical Construction (G.B.) Ltd.
Regal House, Twickenham, Middx. (01-892 4455) (*P.A. & W.A. Venturi Scrubbers*).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant & Services*).

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928 4242) (*Air Pollution Control Engineers*).

Ambuco Limited
Grosvenor House, 125 High Street, Croydon, CR0 1QJ (01-686 0411).

GAS HEATING EQUIPMENT

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
564 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103-105 Pilgrim Street, Newcastle-upon-Tyne (Newcastle 24401).
19–20 Elmdale Road, Bristol, 8 (Bristol 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

GAS SCRUBBERS & WASHERS

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs., WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

Aeronca International Ltd.
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).
Penarth Road, Cardiff, CF1 7UG (Cardiff 37873).
334 Wellington Road North, Stockport, Cheshire (Heaton Moor 8025).

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby-on-Tees, Teesside (064 2 65572).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191) (*Gas Cleaning Plant and Services*).

Chemical Construction (G.B.) Ltd.
Regal House, Twickenham, Middx. (01-892 4455) (*P.A. & W.A. Venturi Scrubbers*).

Drummond Dust & Fume Extractors Ltd.
Gibson House, 800 High Road, Tottenham, N.17 (01-808 6466/8).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

Mikropul Ltd.
Towerfield Industrial Estate, Shoeburyness, Essex, SS3 9QU (Shoeburyness 3511-3 & 2373-5, Telex 99346).

Peabody Ltd.
35 Clapham Park Road, London (01-622 4311/7).

The Midland Heating & Ventilation Co. Ltd.
Bedford Road, Birmingham, 11 (021-772 3781).

Ambuco Limited
Grosvenor House, 125 High Street, Croydon, CR0 1QJ (01-686 0411).

GRIT ARRESTERS

Ambuco Limited
Grosvenor House, 125 High Street, Croydon, CR0 1QJ (01-686 0411).

Joy Manufacturing (U.K.) Ltd.
Western Precipitation Division, Capitol House, Church Street, Epsom, Surrey (Epsom 27661).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 8191) (*Gas Cleaning Plant and Services*).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield, HD1 6RB (Huddersfield 22222).
16 St. James's Street, London, S.W.1 (01-839 6843).

Buell Ltd.
George Street Parade, Birmingham, 3 (021-236 5391).
Simon House, 28–29 Dover Street, London, W1X 4NY (01-493 8191).

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Middlesex (01-898 1821, Telex 262370, Telegrams Godfrepart London).
195 Scotland Street, Glasgow, C.5 (041-429 2131, Telex 77439, Telegrams Howden Glasgow).
14/16 Cockspur Street, London, S.W.1 (01-930 7177, Telex 25149, Telegrams Preheating, London S.W.1).
2 St. John Street, Manchester, 3 (061-834 0181).

HEAT EXCHANGERS

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Middlesex (01-898 1821, Telex 262370, Telegrams Godfrepart London).
195 Scotland Street, Glasgow, C.5 (041-429 2131, Telex 77439, Telegrams Howden Glasgow).
14/16 Cockspur Street, London, S.W.1 (01-930 7177, Telex 25149, Telegrams Preheating, London S.W.1).
2 St. John Street, Manchester, 3 (061-834 0181).

HEATING SYSTEMS—ELECTRIC

Husqvarna Limited
High Lane, Stansted, Essex (Stansted 2611/5).
43 James Watt Place, East Kilbride, Lanarkshire.

HEATING SYSTEMS—OIL

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201, Telex 261076).
Works: Hoval Farrar Boilers Ltd., Newark-on-Trent, Notts. (*Hoval/Biral*).

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
564 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103–105 Pilgrim Street, Newcastle upon Tyne (Newcastle 24401).
19–20 Elmdale Road, Bristol, 8 (Bristol 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

HEATERS, AIR

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
564 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103-105 Pilgrim Street, Newcastle-on-Tyne (Newcastle 24401).
19–20 Elmdale Road, Bristol, 8 (Bristol 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

Auto Combustions (London) Ltd.
360–364 Wandsworth Road, London, S.W.8 (01-622 9121) (*Direct and indirect Air Heaters and Heat Exchangers*).

HEATING EQUIPMENT, INDUSTRIAL (PROCESS SPACE)

Spencer & Halstead Ltd.
Ossett, Yorks. (Ossett 5121) (*Spenstead*).

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
564 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103–105 Pilgrim Street, Newcastle-on-Tyne (Newcastle 24401).
19–20 Elmdale Road, Bristol, 8 (Bristol 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

HUMIDIFIERS

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

Heather Filters Ltd.
Rosemount Towers, Wallington, Surrey (01-647 2071) (*Satomair*).

Spencer & Halstead Ltd.
Ossett, Yorks. (Ossett 5121) (*Spenstead*).

INCANDESCENT/WHITING WET ARRESTERS FOR CUPOLAS

Wellman Incandescent Furnace Co. Ltd.
Cornwall Road, Smethwick, Warley, Worcs. (021-558 3151).

INCINERATORS

Babcock & Wilcox Ltd.
Haddon House, 2/4 Fitzroy Street, London, W1P 5AD (01-388 0331).

The Incinerator Company Ltd.
14 Coopers Row, London, E.C.3 (01-709 9931).

Victor Products (Wallsend) Ltd.
P.O. Box 10, Wallsend, Northumberland (Wallsend 6283 31).
50 Pall Mall, London, S.W.1 (01-930 7142).
Victoria Chambers, Dale Road, Matlock, Derbyshire (Matlock 2318) (*Victor Incinerators*).

Universal Machinery and Services Limited
Millshaw, Leeds, LS11 8EQ (Leeds 73761) (*Universal Smokeless Incinerators*).

Peabody Limited
35 Clapham Park Road, London, S.W.4 (01-622 4311/7).

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby-on-Tees, Teesside (064 2 65572).

INDICATORS, HUMIDITY

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London, N.1 (01-253 8581).

The General Electric Co. Ltd., Witton Kramer Division
P.O. Box 501, Electric Avenue, Birmingham, B6 7JP (021-327 3241).

INSTRUMENTS, GAUGES, METERS, ETC.

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London, N.1 (01-253 8581).

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

LABORATORY FUME CABINETS

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs., WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

LECTURE, FILMSTRIPS & NOTES

Diana Wyllie Ltd.
3 Park Road, Baker Street, London, N.W.1 (01-723 7333/3330).

ODOUR CONTROL

Izal Ltd.
Thorncliffe, Chapeltown, Sheffield, S30 4YP (Ecclesfield 3171).
Grand Buildings, Trafalgar Square, W.C.2 (01-839 7141) (*Airkem*).

PERFORATED METAL

J & F. Pool Ltd.
Hayle, Cornwall (Hayle 3213) (Telex 45286).

PUMPS

Lambert Brothers (Walsall) Ltd.
Walstead Road West, Walsall, Staffs., WS5 4BA (Walsall 21585).
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Surrey (Byfleet 43224) (*Pumps*).

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201, Telex 261076).
Works: Hoval Farrar Boilers Ltd., Newark on Trent, Notts. (*Hoval/Biral*).

RADIANT HEATING

Harris Equipment Ltd.
Longfield Road, Tunbridge Wells, Kent (Tunbridge Wells 23401) (Telex 95181).
564 High Road, Leytonstone, E.11 (01-539 7453).
Wellington House, 103–105 Pilgrim Street, Newcastle-upon-Tyne (Newcastle 24401).
19–20 Elmdale Road, Bristol, 8 (Bristol 30371).
Norwich Union House, 40 Trinity Street, Hanley, Stoke-on-Trent (Stoke-on-Trent 22031) (*Industrial Space Heating and Air Filtration Equipment*).

REFRIGERATION PLANT

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity, Temperature Control*).

RESEARCH AND DEVELOPMENT FACILITIES

Head Wrightson Process Engineering Ltd.
P.O. Box 10, Teesdale Works, Thornaby-on-Tees, Teesside, England (064 2 65572).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham, 3 (021-236 3388).
Simon House, 28–29 Dover Street, London, W.1 (01-493 8191).

The British Non-Ferrous Metals Research Association
Euston Street, London, NW1 2EU (01-387 6411).

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Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

ROOM HEATERS—GAS

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Essex Works, Thimble Mill Lane, Aston, Birmingham, B6 7QZ (021-327 1580).

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P.O. Box 501, Electric Avenue, Birmingham, B6 7JP (021-327 3241).

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STOKERS, INDUSTRIAL

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The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

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Felvic Industries
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C. F. Casella & Co. Ltd.
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Works: Hoval Farrar Boilers Ltd., Newark on Trent, Notts. (*Hoval/Biral*).

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The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (78125).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) (Telex 896501) (*Humidity & Temperature Control*).

Morgan Air Treatments Ltd.
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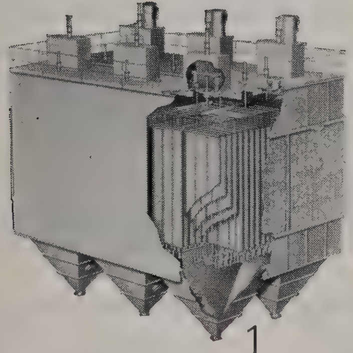
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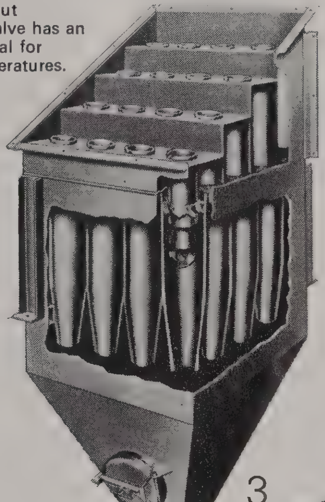
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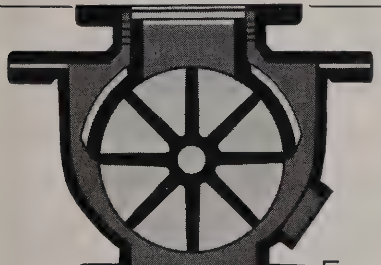
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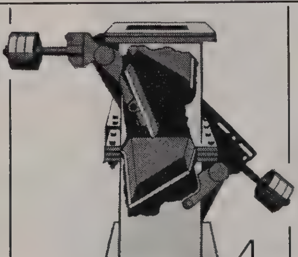
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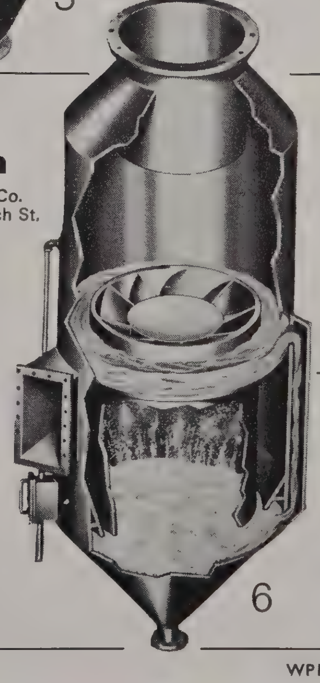
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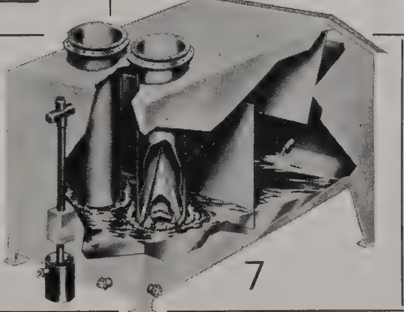
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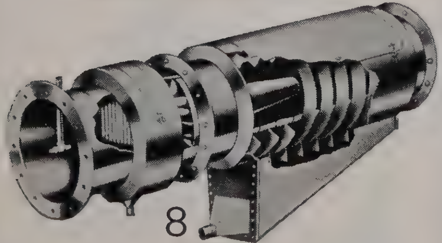
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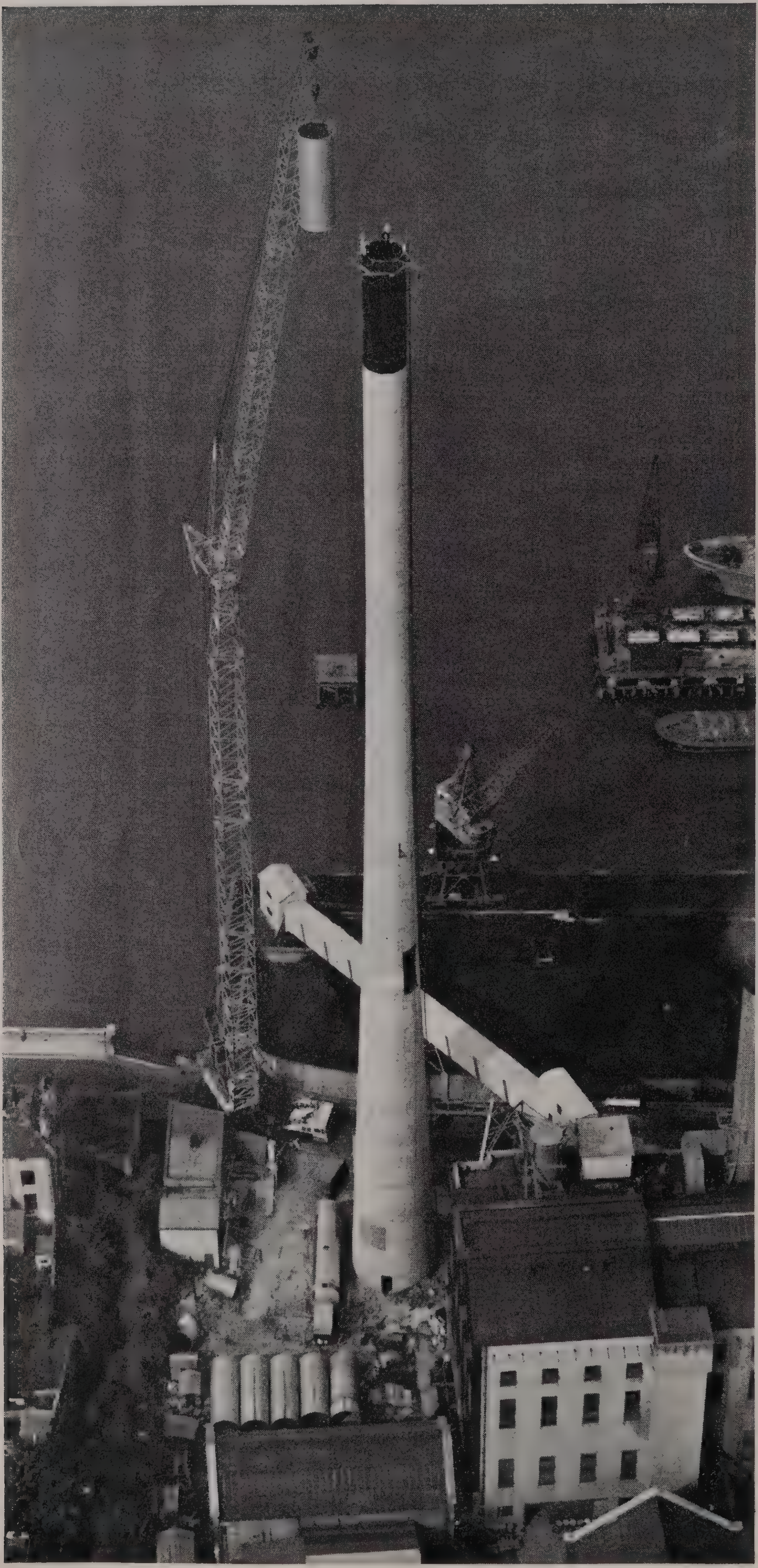

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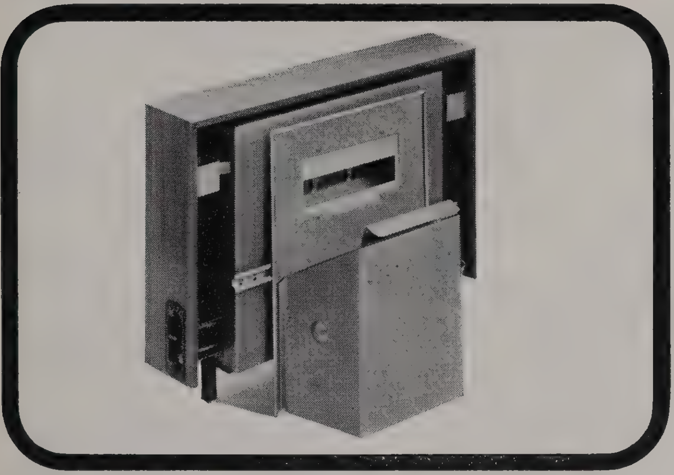

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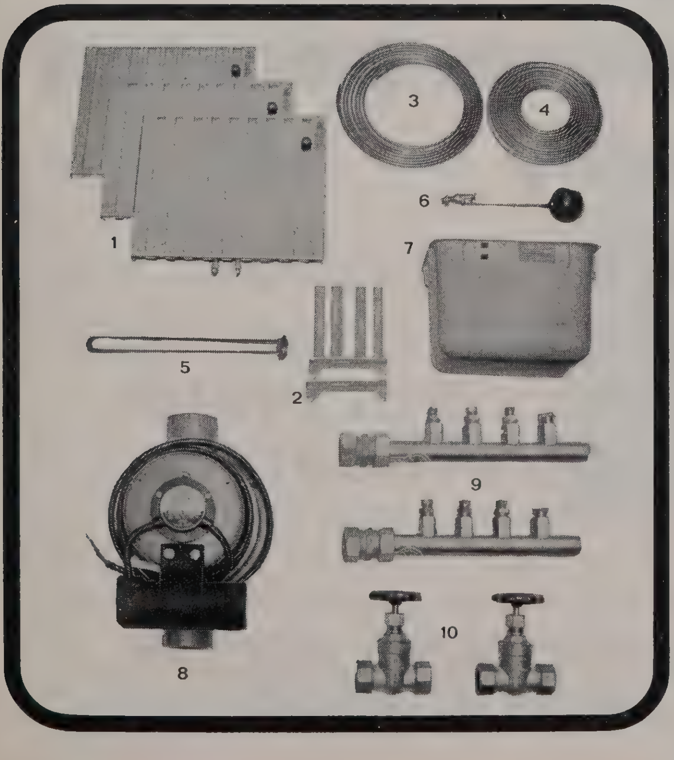

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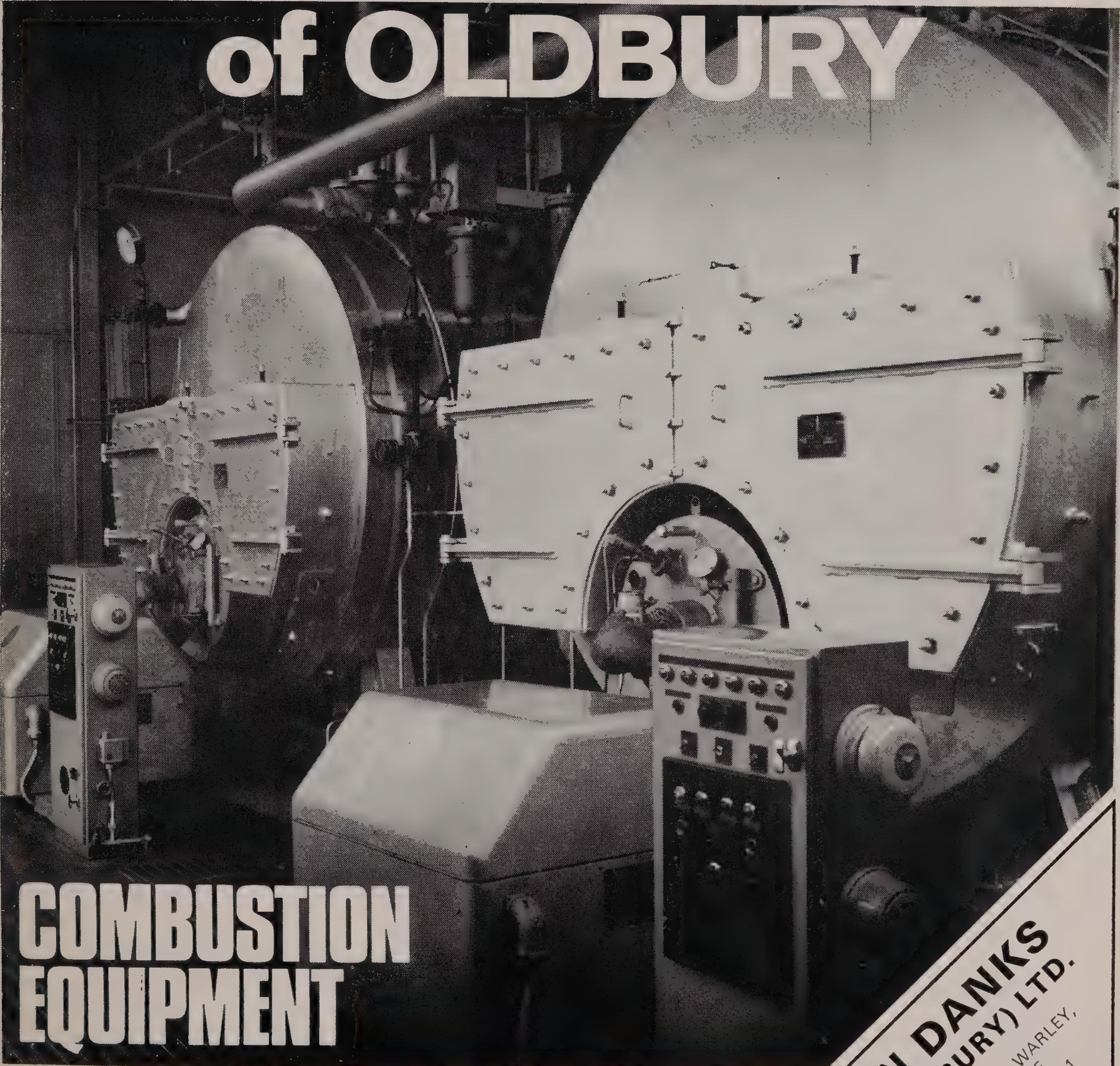

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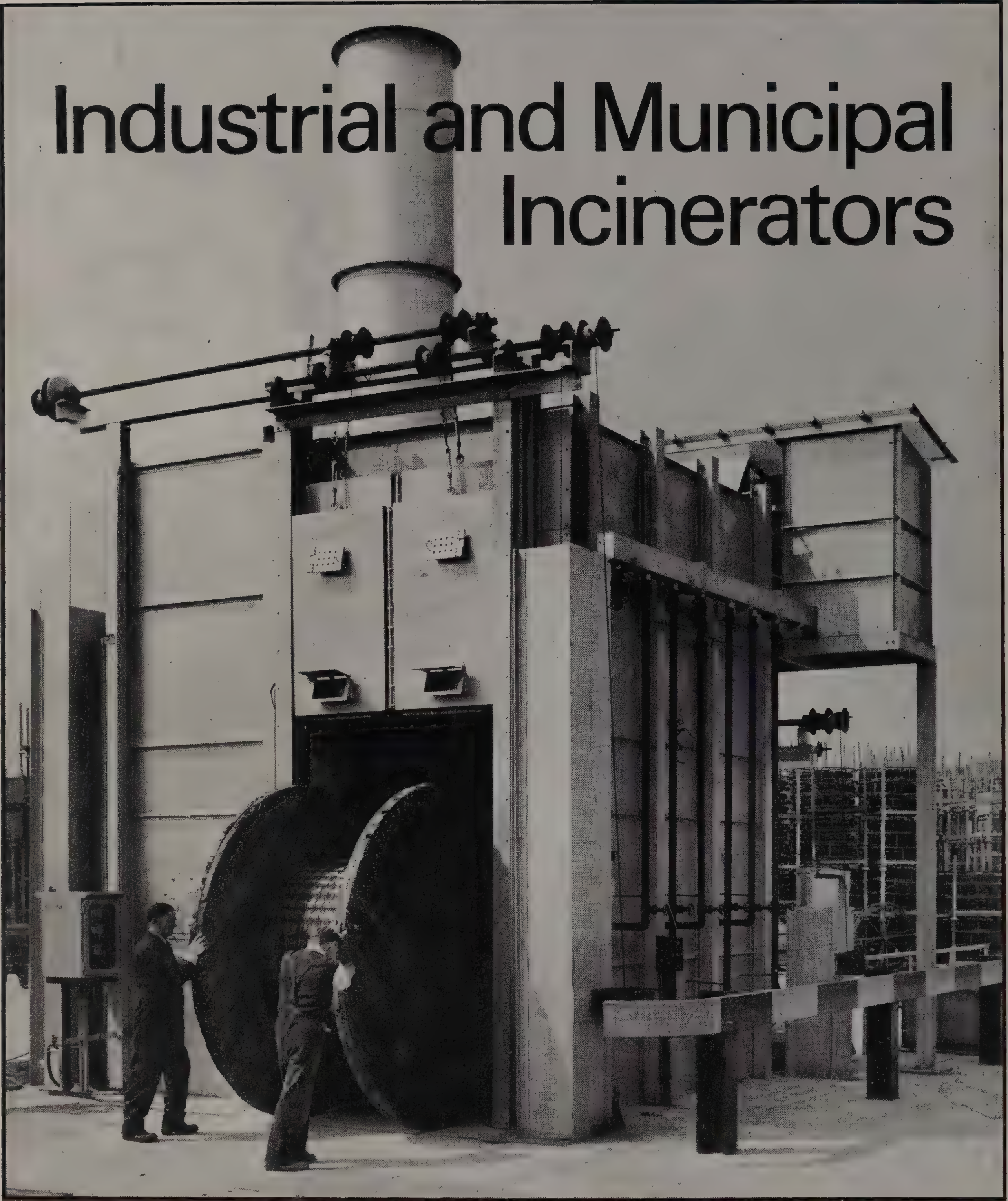

The Incinerator Company Limited
14 Coopers Row, London, E.C.3. Tel: 01-709-9931

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CLEAN AIR YEAR BOOK

1973

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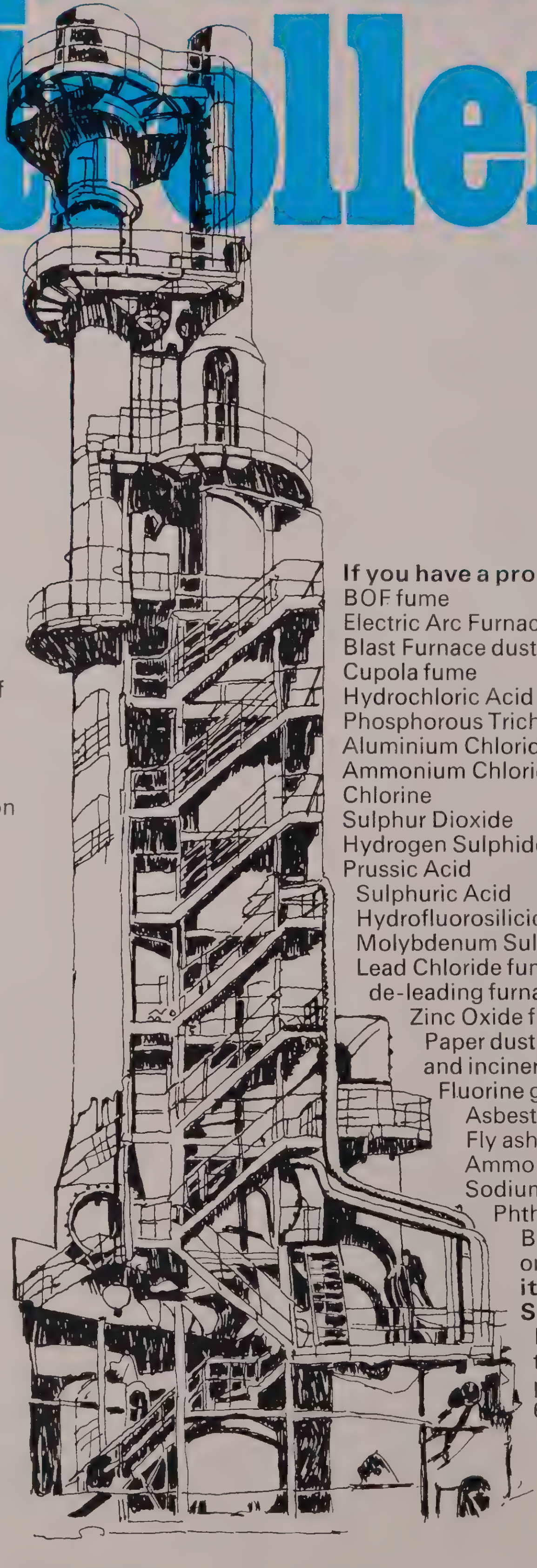

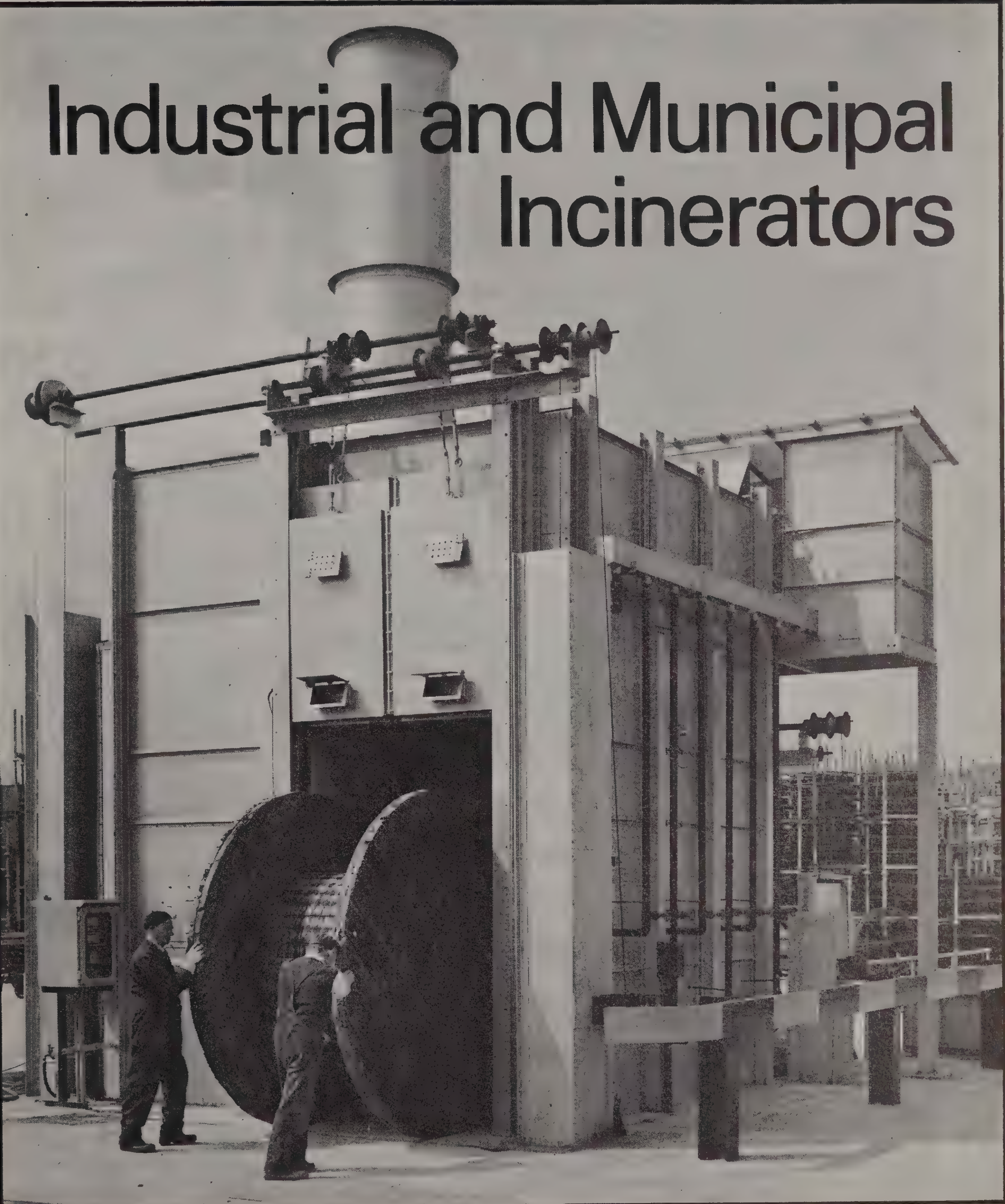

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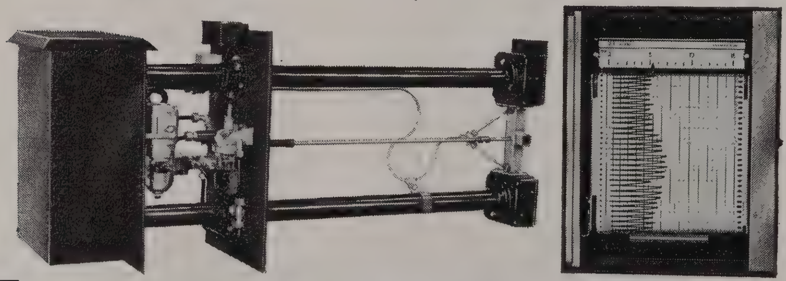

Foster Cambridge Dust Monitor

CLEAN AIR YEAR BOOK
1973

Contents

Section 1

Clean Air Progress 5

Section 2

British Standards Relating to Air Pollution 9
The History of Air Pollution in Great Britain 10
The Cost of Air Pollution 13
Estimates of Air Pollution in the United Kingdom in the year 1970/71 14
Smoke Control Areas 16
Major Smog Disasters 23
An Outline of the Law Relating to Air Pollution 25
The Ringelmann Chart 44

Section 3

Air Pollution Research Programmes in the United Kingdom 49
The Warren Spring Laboratory of the Department of Trade and Industry 67
The Central Electricity Generating Board 68
The Atomic Energy Research Establishment 69
The Medical Research Council's Air Pollution Research Unit 70
The National Industrial Fuel Efficiency Service Ltd 72
Imperial Chemical Industries Ltd 72

Section 4

Recent Books, Papers and Reports 75
Films and Filmstrips 76
Guide to Publications 78
Services Provided by the NSCA 84
The Clean Air Case 85

Section 5

Directory of Consultants 87
The International Union of Air Pollution Prevention Associations 89
Directory of Organizations 90
Trade Directory and Buyers Guide 94

Section 6

NSCA Officers, Council and Staff 108
Information about the Society 109
Membership and Subscriptions 109
NSCA List of Members 110
NSCA Annual Report and Accounts 116
Divisional Reports 122

Index to Advertisers

Newton Chambers Engineering Ltd Cover ii
The Incinerator Company Ltd 1
Foster Cambridge Ltd 2
F. E. Beaumont Ltd 4
National Coal Board 7
Shell-Mex & B.P. Ltd 8
Electricity Council 12
Geldia (London) Ltd 15
Western Precipitation 24
Collectron (Dust Control) Ltd 46
Universal Machinery and Services Ltd 47
Lodge-Cottrell Ltd 48
John Zink Company Ltd 66
C.Z. Scientific Instruments Ltd 73
National Carbonising Company Ltd 74
Solid Smokeless Fuels Federation 80
Parkray Ltd 86
Dust Suppression Ltd 88
Diana Wyllie Ltd 89
The Rolfite Company Ltd 106
C.F. Casella and Company Ltd 107
Coalite and Chemical Products Ltd Cover iii
Nailsea Engineering Company Ltd Cover iv

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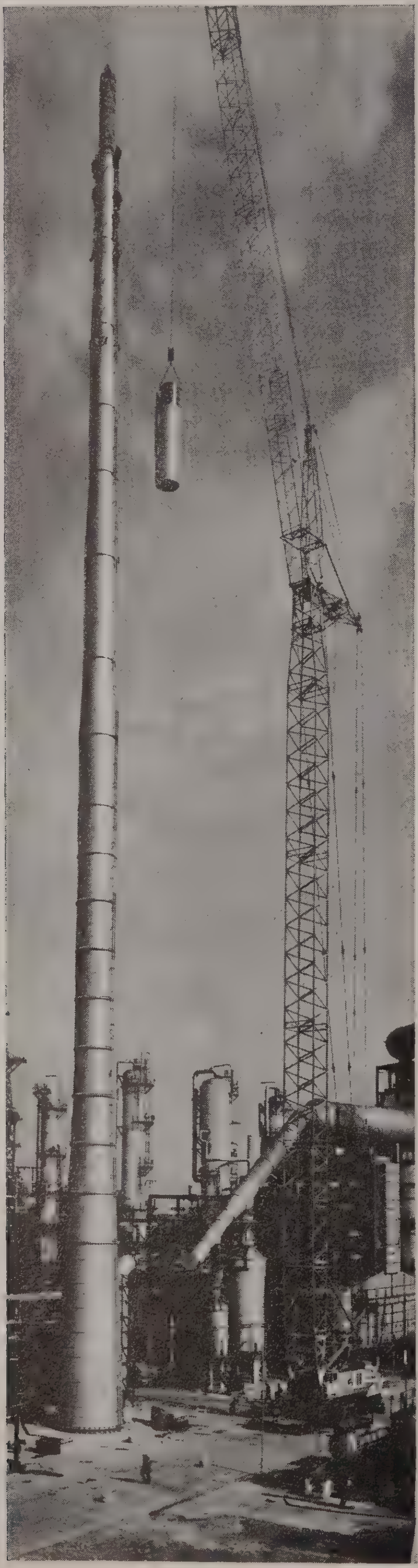

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Telex: 338146

Section 1

Clean Air Progress

A Review for 1971/72

It has been the custom in the past to review progress for the previous 12 months. However, this year a change has been made because, in future, the Clean Air Year Book will be published annually on the 1st January. This is the Clean Air Year Book 1973, and consequently the period under review is rather longer than usual and covers about 15 months.

1970 was European Conservation Year and there is no doubt that the publicity that this received did serve to awaken interest in the environment. What was not known then was whether or not this interest would endure. In the event, it seems that as was to be expected, quite a lot of popular interest has died away, but what has remained is much more valuable. This is a real interest amongst people who are seeking information and who have a real intention of acting on this information. It is to be hoped that this steady, common-sense approach to the problems of the environment will continue.

On the international front, the main interest has been centred on the United Nations Conference on the Human Environment held in Stockholm from the 5th to the 16th June 1972. This was a conference of high endeavour which served to give meaning to its slogan "Only one earth", and which explored the problems of the human environment in the broadest sense. Although at the start of the conference there was a clash of outlook between the more wealthy nations and the poorer nations, towards the end there emerged the beginnings of a common understanding of each other's problems. It is to be hoped that this will have a highly significant bearing on the future setting of environmental standards. An encouraging feature of the conference was the clear recognition of the need for wide ranging scientific research on the many problems of the human environment, to which end over 100 proposals for action were adopted. A great deal of work was put into the preparation of the evidence which the various nations submitted to the conference. In all there were about 12,000 pages in 350 basic documents. Four of these, "Nuisance or Nemesis?", "Sinews for Survival", "How Do You Want to Live?" and "Fifty Million Volunteers" are studies of public opinion in the United Kingdom undertaken by four separate working parties at the request of the Secretary of State for the Environment. These four booklets are a digest of the vast amount of evidence submitted by organisations and individuals in this country. They are well worth reading and provide an excellent guide to the state of our environment now and what people think it should be in the future.

The tumult and the shouting—and there was some shouting—of the conference has now died and the various governmental delegations have departed. What now remains to be seen is whether the various recommendations are properly and thoroughly implemented. If they are, this will be a major step forward for mankind as a whole; if they are not, the whole exercise will have been a waste of time.

Turning more specifically to clean air, 1970 was the year in which there was a severe shortage of solid smokeless fuel and which caused the suspension of more than 550 Smoke Control Orders. 1971 was the period of recuperation when, as fuel became available, it was possible to re-impose these suspended Orders and in which new Orders began to be brought into operation again. But 1972, at the time of writing, promises to be a vintage year for smoke control. The Department of the Environment Circular Number 53/71, published on the 26th July 1971, read as follows "The Secretary of State hoped that authorities who during the past two or three years have reduced or discontinued their smoke control programmes will now resume them energetically. In particular, he is anxious to see good progress in the "black" areas and accordingly I am to ask all "black" area authorities to review their programmes and consider whether more rapid progress can be achieved. There is no longer any cause for any local authority—"black" or "white"—to refrain from proceeding with a programme and I am to emphasise that the Secretary of State wishes to give every encouragement to smoke control and hopes to receive a large number of Orders." Side by side with this encouragement from the Secretary of State, the National Society for Clean Air, through its Divisions in the field, also made an approach to all local authorities asking them to make greater efforts. This joint approach seems to have been successful because it is now almost certain that there will be as many Smoke Control Orders brought into operation in 1972 as in the previous peak year of 1967.

Nevertheless, in spite of this very heartening progress in smoke control, the Secretary of State was not entirely satisfied that enough progress was being made in the North Eastern part of the country. Accordingly, a special panel of the Clean Air Council were appointed "to examine the progress of domestic smoke control in the 'black' areas of the Northern Region, to suggest improvements insofar as practicable, and to advise the Clean Air Council upon any further steps which should be taken to this end". The members of this panel visited the Northern Region and heard evidence on the spot from the people concerned. The very fact of the panel doing this has already had a very stimulating effect on the region and the smoke control programme there has accordingly been stepped up.

But it is not only in the smoke control front that progress has been made. For many years the National Society for Clean Air have been pressing the government to introduce legislation to control the emissions from road vehicles. In the latter part of the summer of 1972 the Department of the Environment consulted interested organisations—amongst them the Society—on a proposal that by October 1973, new petrol-engined vehicles should comply with the limits of emission of carbon monoxide and hydrocarbons laid down by ECE Regulation No. 15. This Regulation, if brought into force will apply to petrol-engined vehicles first used on or after the 1st October 1973 and not manufactured before the 1st April 1973; that is to say the Regulation will apply to new cars and not those already on the road. It should have the effect of reducing emissions of carbon monoxide by up to 30% and hydrocarbons by up to 10% as compared with the emissions of an uncontrolled vehicle. This will be achieved by improved carburettation and better timing and ignition controls. The ECE Regulation No. 15 requires that a car shall be tested for verification of the average emission of pollutants in a congested urban area after a cold start. The carbon monoxide content of the exhaust gases emitted with the engine idling must not exceed 4.5% by volume. The regulation which requires the fitting of a device to prevent gases escaping from the crankcase has already been law in this country for new vehicles registered since the 1st January 1972.

Although there are some who would like to have seen proposals for more stringent regulations, especially as the proposed regulations will apply to new cars only, the Department of the Environment have stated that they hope to introduce arrangements for retesting vehicles at regular intervals shortly and that they are participating in discussions in ECE on strengthening these standards and extending them to cover the oxides of nitrogen; it is also intended that in due course the regulations should apply to vehicles already in use.

In August 1972 the Secretary of State for the Environment announced a programme for the phased reduction of the lead content in petrol. It was considered that present levels of lead emission should not be exceeded and should if possible be reduced. The programme announced should achieve substantial reductions in emissions of lead from vehicles. Maximum lead content will be reduced as follows—by the end of 1972 0.64 grammes/litre, by the end of 1973 0.55 grammes/litre, by the end of 1975 0.45 grammes/litre.

So far as smoke from diesel-engined vehicles is concerned, in June 1972 the Minister for Transport Industries laid before Parliament regulations which will require all diesel-engined vehicles first used on or after 1st April 1973 and not manufactured before 1st October 1972 to comply with the smoke emission limits laid down in the British Standard on diesel engines, BS AU 141A/1971. This measure should ensure that smoke emitted is barely visible under all normal operating conditions. Further, the Department of the Environment are currently reviewing ways of strengthening controls over vehicles already in use, including the possibility of replacing by an instrumental check the present visual check on smoke emission in the annual heavy goods vehicle tests.

Although all the above proposed legislation with regard to road vehicles may not seem to some people to go far enough, it is welcomed as a very promising step in the right direction.

In our last review we considered that the period 1970 to 71 had been one of preparation and promise, and looked forward to reaping the fruits of this in the months and years ahead. We can now say at the end of 1972 that much of that promise has been realised and, more than this, that the future also promises well.

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Section 2

British Standards Relating to Air Pollution

B.S.

758 Small domestic hot-water supply boilers using solid fuel.
Part 1: 1955 Manually controlled boilers. Amendments PD 2418, 1956; PD 2698, 1957; PD 4317, 1961; PD 4432, 1962.
Part 2: 1960 Thermostat-controlled boilers. Amendment PD 4139, 1961.

893 Methods of testing dust extraction plant and the emission of solids from chimneys of electric power stations. 1940. Amendment PD 26, 1942.

1251 Open fireplace components. 1970.
Four sections dealing with:—
1. Firebacks for 350mm, 400mm and 450mm open fires.
2. Fireplace surrounds and hearths.
3. Adjustable chimney-throat restrictors.
4. Lintels for open fire assemblies.

1252 Domestic solid fuel cookers with integral boilers. 1957. Amendments PD 3383, 1959; PD 4212, 1961; PD 4822, 1963.

1334 The use of thermal insulating materials for central heating and hot and cold water supply installations. 1969. (Metric).

1747 Methods for the measurement of air pollution. (Metric).
Part 1: 1961. Deposit Gauges.
Part 2: 1969. Determination of concentration of suspended matter.
Part 3: 1969. Determination of sulphur dioxide.
Part 4: 1969 The lead dioxide method.
Part 5: 1972. Directional dust gauges.

1756 Methods for the sampling and analysis of flue gases. 1971.
Part 1: 1971. Methods of sampling.
Part 2: 1971. Analysis by the Orsat apparatus.
Part 3: 1971. Analysis by the Haldane apparatus.
Part 4: 1965. Miscellaneous analyses. Amendment PD 5858, 1966.
Part 5: 1971. Semi-routine analyses.

1816 Heavy duty cooking ranges (solid fuel) 1957. Amendment PD 2814, 1957.

1846 Glossary of terms relating to solid fuel burning equipment.
Part 1: 1968. Domestic appliances.
Part 2: 1968. Industrial water heating and steam-raising installations.

B.S.

2740 Simple smoke alarms and alarm metering devices, 1969. (Metric).

2741 Recommendations for the construction of simple smoke viewers. 1969. (Metric).

2742 Notes on the use of the Ringelmann and miniature smoke charts. 1969. (Metric). Addendum No. 1. (1972). The calibration of instruments in Ringelmann numbers.

2742C Ringelmann Chart. 1957.

2742M Miniature smoke chart. 1960.

2811 Smoke density indicators and recorders. 1969. (Metric).

2845 Coke-burning inset open fires without boiler and without convection.
Part 1: 1957. Dimensional and constructional requirements. Amendments PD 3517, 1959; PD 3981, 1960.
Part 2: 1959. Performance and constructional requirements. Amendments PD 3668, 1960; PD 3982, 1960; PD 4848, 1963.

3048 Code for the continuous sampling and automatic analysis of flue gases. Indicators and recorders. 1968. (Complementary to B.S. 1756, which covers manually operated instruments.)

3107 Small incinerators for the destruction of hospital dressings. 1959.

3128 Constructional and performance requirements for inset open fires with boiler and without convection. 1959. Amendments PD 3667, 1960; PD 3980, 1960; PD 4100, 1961; PD 4849, 1963; PD 5517, 1965.

3142 Manufactured solid smokeless fuels for household use.
Part 1: 1965. Cokes for domestic open fires.
Part 2: 1965. Cokes for domestic closed appliances.
Part 3: 1970. Specially reactive fuels for all types of domestic open fire.

3250 The thermal testing of domestic solid fuel burning appliances with convection.
Part 1: 1960. Flue loss method. Amendment PD 5140, 1964.
Part 2: 1961. Hood method. Amendment PD 4205, 1961.

3316 Large incinerators for the destruction of hospital waste. 1960.

3328 Domestic gas pokers and portable underbar ignition burners. 1961.

B.S.	
3376	Open fires with convection, with or without boiler. 1961.
3377	Back boilers for use with domestic solid fuel appliances. 1969. (Metric).
3378	Domestic heating stores using coke and other solid fuels. 1961.
3405	Simplified methods for measurement of grit and dust emission. 1971.
3813	Incinerators for waste from trade and residential premises. Part 1: 1964. Capacities between 50 lb./h. and 1000 lb./h.
3841	Method for the measurement of smoke from manufactured solid fuels for domestic open fires. 1972.
3929	Domestic solid fuel ignition pokers and portable undergrate ignition burners for use with commercial butane. 1965.
4076	Steel chimneys. 1966.
4433	Independent thermostatically controlled central heating boilers, with rated outputs up to 44kW. (Metric). Part 1: 1969. Boilers with undergrate ash removal designed to burn solid smokeless fuels. Part 2: 1969. Gravity feed boilers designed to burn small anthracite.
PD 6434	Recommendations for the design and testing of smoke reducing solid fuel burning domestic appliances. 1969.
AU 141a	The performance of diesel engines for road vehicles. 1971.

All the above Standards are obtainable direct from the British Standards Institution at British Standards House, 2 Park Street, London, W.1. (individual copies) or Newton House, 101-113, Pentonville Road, London, N.1. (bulk orders). British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The History of Air Pollution in Great Britain

852	First records of the use of coal in England.
1228	Record of "Sacoles Lane" (sea-coals) in London.
1257	Eleanor, Queen of Henry III, left Nottingham for Tutbury on account of the smoke nuisance.
1273	Use of coal prohibited in London as being "prejudicial to health".
1306	Royal Proclamation prohibiting artificers from using sea-coal in their furnaces. Record of the execution of one offender.
1307	Commission of Inquiry appointed to "inquire of all such who burnt sea-coal in the city or parts adjoining, and to punish them for the first offence with great fines and ransoms, and upon the second offence to demolish their furnaces".
1563	Scarcity of wood fuel led to an Act prohibiting the export of wood. Consequent expansion of the coal trade.
1578	Queen Elizabeth I "findeth hersealfe greately greved and annoyed with the taste and smoke of the seacooles". Westminster brewers offered to burn wood because of her objection to coal smoke. Elizabeth, James I and Charles I all imposed export duties on coal.
1595	Thomas Owen brought Welsh coal and anthracite to London to demonstrate its smokelessness.
XVI century	(Elizabeth's reign). Prohibition of coal in London whilst Parliament was sitting.
1603	Sir Hugh Platt's smokeless briquettes.
1648	Petition of Londoners to Parliament to prohibit the importation of coal from Newcastle on account of the injury they experienced.
1661	John Evelyn submitted his "Fumifugium, or the Smoake of London Dissipated", to Charles II.
1700	Publication of "Campania Foelix", with a "Discourse on the Fuel of London", by Timothy Nourse,—mentioned the "stink" of coal.
Circ. **1799**	Benjamin Thompson's smokeless grates.
1801	Manchester Corporation Nuisance Committee on "Smoake".
1819	Committee appointed by Parliament to inquire how far persons using steam engines and furnaces could erect them in a manner less prejudicial to public health and comfort.
1843	A Select Committee recommended the introduction of a Bill dealing with nuisances from furnaces and steam engines.
1845	Another Select Committee reported that it was not desirable to extend the provisions of an Act beyond furnaces used for steam generation.
1845	Manchester cotton mill was observed to emit black smoke for 8 hrs. 52 mins. out of 9 hrs.
1845	Railway Clauses Consolidated Act requiring engines to consume their own smoke.
1847	The Town Improvement Clauses Act contained a section dealing with factory smoke.
1850	Manchester Smoke Inspector's Report—over 500 factory premises inspected—300 notices or cautions issued.
1853-6	Smoke Abatement Acts relating to the Metropolitan area.
1863	Alkali, etc. Works Regulation Act.
1866	The Sanitary Act empowered sanitary authorities to take action in cases of smoke nuisances.
1875	The Public Health Act containing a smoke abatement section on which legislation to the present day has been based.
1881	Formation of a Smoke Abatement Committee as a result of a movement started by the Kyrle Society and the Public Health Society.
1881	Smoke Abatement Exhibition at South Kensington organized by the Public Health and Kyrle Societies.
1882	Formation of the National Smoke Abatement Institution.
1882	Manchester Noxious Vapours Association held an exhibition.

1887	Failure of the Smoke Abatement (Metropolis) Bill in the House of Lords.
1891	The Public Health (London) Act.
1899	Formation of the Coal Smoke Abatement Society, led by Sir William Richmond, R.A., and Dr. H. A. Des Vœux (concerned mainly with London).
1903	Birmingham had four smoke inspectors.
1904	London County Council published a comprehensive report on the London smoke problem.
1905	The Government published a report on laws regarding smoke in other countries.
1905	Leeds appointed a full time smoke inspector. About this time the London Coal Smoke Abatement Society appointed smoke inspectors, but found little official support.
1906	The Alkali, etc. Works Regulation Act, which extended and consolidated previous similar Acts.
1909	Sheffield Smoke Abatement Exhibition, at which was set up the Smoke Abatement League of Great Britain (mainly for the provinces and centred later in Manchester and Glasgow).
1912	International Smoke Abatement Exhibition in London, organized by the Coal Smoke Abatement Society, leading to the formation of a Committee for the Investigation of Atmospheric Pollution.
1913	Smoke Abatement Bill introduced in the House of Commons by A. G. C. Harvey, M.P.
1914	Smoke Abatement Bill introduced in the House of Lords by Lord Newton. Withdrawn on the appointment of a Departmental Committee to investigate the problem.
1920	Committee re-formed after the war with Lord Newton as Chairman — they issued an Interim Report—dealing largely with domestic smoke.
1921	Publication of the Final Report of the Newton Committee.
1926	Public Health (Smoke Abatement) Act by which the 1875 and 1891 Acts were amended and extended.
1927	Establishment of first regional committees of local authorities.
1929	Amalgamation of the Coal Smoke Abatement Society and Smoke Abatement League of Great Britain to form the National Smoke Abatement Society. First publication of a journal (*Clean Air*) devoted to air pollution.
1935	First records of completely smokeless housing estates.
1936	Public Health Act, in which were included the provisions of the Smoke Abatement Act of 1926.
1946	Simon Report on Domestic Fuel Policy, recommending, *inter alia*, measures for domestic smoke prevention.
1946	First smokeless zone and prior approval legislation (Manchester Corporation Act).
1951	First smokeless zone established (in Coventry).
1952	Ridley Report on "Policy for the Use of Fuel and Power Resources", recommending, *inter alia*, measures for smoke prevention.
1952	London smog disaster, the most serious for many years, with a death roll of 4,000 (*q.v.*).
1953	Beaver Committee on Air Pollution was set up by the Government and published an Interim Report.
1954	Final Report of the Beaver Committee.
1954	A Clean Air Bill introduced by Gerald Nabarro, M.P., and withdrawn (4 February 1955) on Government undertaking to introduce their own Bill.
1955	Whole of City of London declared a smokeless zone.
1956	Clean Air Act.
1958	National Smoke Abatement Society became incorporated under new name of National Society for Clean Air.
1959	International Diamond Jubilee Clean Air Conference and Exhibition (N.S.C.A.), London.
1962	Smog episode in London and other cities. Estimated death roll of 750 in Greater London.
1962	Holborn M.B. first local authority in country to reach its final target under Clean Air Act.
1964	Amendments to Clean Air Act in Housing Act, 1964, modifying smoke control area policy. Clean Air Act (Northern Ireland).
1966	First Congress of the new International Union of Air Pollution Prevention Associations (in London).
1966	Alkali, etc. Works Order revoked all earlier seven Orders and consolidated them, making a few minor alterations to the lists of scheduled works and noxious or offensive gases.
1968	Clean Air Act passed.
1969	Clean Air Act brought into operation.
1970	Second Congress of the International Union of Air Pollution Prevention Associations (in Washington).
1971	The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations and the Clean Air (Emission of Grit and Dust from Furnaces) Regulations.
1971	The Alkali & C. Works Order.
1971	The Royal Commission on Environmental Pollution.
1972	U.N. Conference on the Human Environment, Stockholm.

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The Cost of Air Pollution

Until recently, the most up-to-date general enquiry into the cost of air pollution in Britain was that made by a sub-committee of the Beaver Committee, the findings of which were included as an appendix in the final report of the Committee in 1954. The total estimate cost was given as £250m. a year.

In November 1972, the Programmes and Analysis Unit of the Department of Trade and Industry and the United Kingdom Atomic Energy Authority published their report "An Economic and Technical Appraisal of Air Pollution in the United Kingdom". This report quoted the direct annual cost of air pollution as some £410m. a year, the major items of which are:

	£m per annum
Laundry etc,	½
Window cleaning	5
Corrosion and protection of metals	42
Textiles, paper, etc.	33
Agricultural produce	195
Health	130

In addition, the report estimated that there is a "social" or disamenity cost to the country of £780m. a year, which includes £510m. for health and £100m. for amenity.

The total cost of air pollution in the United Kingdom may therefore be said to be of the order of £1190m. a year, which represents about two per cent of the gross national product.

Expenditure on Air Pollution Control

The amount of money spent by scheduled works in capital working costs between 1958 and 1968 has been estimated from the returns submitted and is summarised in the table below. Working costs include depreciation and interest, operations, maintenance and repairs, overheads and miscellaneous.

(From the 105th Annual Report of the Chief Alkali Inspector, 1968)

Works	*Capital*	*Research and Development*	*10-year Working Costs*	*Latest year's Working Costs*
1. Electricity	75,731,000	856,000	126,691,000	15,300,000
2. Cement	6,216,000	301,000	6,442,000	1,000,000
3. Petroleum	6,822,000	536,000	11,667,000	1,788,000
4. Gas	2,839,000	—	4,474,000	350,000
5. Coke Ovens	2,909,000	242,000	6,126,000	710,000
6. Lime	976,000	4,000	707,000	118,000
7. Ceramics	2,090,000	163,000	3,011,000	382,000
8. Iron and Steel	26,430,000	1,235,000	93,351,000	10,364,000
9. Non-ferrous Metals	5,762,000	656,000	16,449,000	2,262,000
10. Chemical	20,527,000	952,000	55,516,000	6,782,000
TOTALS (£)	**150,302,000**	**4,945,000**	**324,434,000**	**39,056,000**

Estimates of Air Pollution in the United Kingdom in the year 1970/71

Table 1

Estimates of Pollution by Smoke and Oxides of Sulphur in Million Metric Tonnes from the Main Uses of Primary Forms of Energy

(*one metric tonne=0·9842 long ton*)

Estimates prepared by Albert Parker, CBE, DSc

Figures for quantities of forms of energy were derived from the Digest of Energy Statistics issued in 1971 by the Department of Trade and Industry

Form of Energy and Class of Consumer	*Quantity of Energy*	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miners' coal	20·2	0·64
Railways	0·1	small
Industrial and miscellaneous including collieries	25·6	0·08
	45·9	0·72
Sulphur oxides		
Coal		
Domestic, including miners' coal	20·2	0·45
Electricity power stations	77·2	2·15
Railways	0·1	small
Collieries	1·9	0·06
Industrial and miscellaneous	23·7	0·62
Coke ovens	25·3	0·08
Gas supply industry	4·3	0·03
Low temperature carbonization plants	2·6	0·01
Patent fuel plants	1·5	small
	156·8	3·40
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels	5·3	0·09
Industrial and miscellaneous	4·7	0·08
	10·0	0·17
Oil		
Domestic	3·0	0·02
Industrial and commercial	51·6	2·39
Gas supply industry	3·7	small
Road transport	19·3	0·05
Railways	1·1	0·01
Marine craft (inland)	1·1	0·03
	79·8	2·50
Sulphur oxides overall total		6·07
Hydro-electricity (coal equivalent)	2·6	
Nuclear-electricity (coal equivalent)	9·6	
Natural gas (coal equivalent)	16·3	
Total coal equivalent, including oil at 1 tonne=1·7 tonnes of coal and including petroleum gases	333·3	

The amount of 51·6 million tonnes of oil used in 1970-71 for industrial and commercial purposes is equivalent in heating value to about 87·7 million tonnes of coal, which if used for the same purposes would have produced about 0·26 million tonnes of smoke and nearly 2·4 million tonnes of oxides of sulphur. The total amount of 6·07 million tonnes of oxides of sulphur is 1·82 per cent of the total coal equivalent of 333·3 million tonnes; the total amount of oxides of sulphur in 1969-70 was 1·94 per cent of the total coal equivalent.

Of the 51·6 million tonnes of oil 12·6 million tonnes was used by the electricity power stations.

Table 2

Estimates of Pollutants from Road Vehicles in the United Kingdom in the Year 1970-71 in Million Tonnes

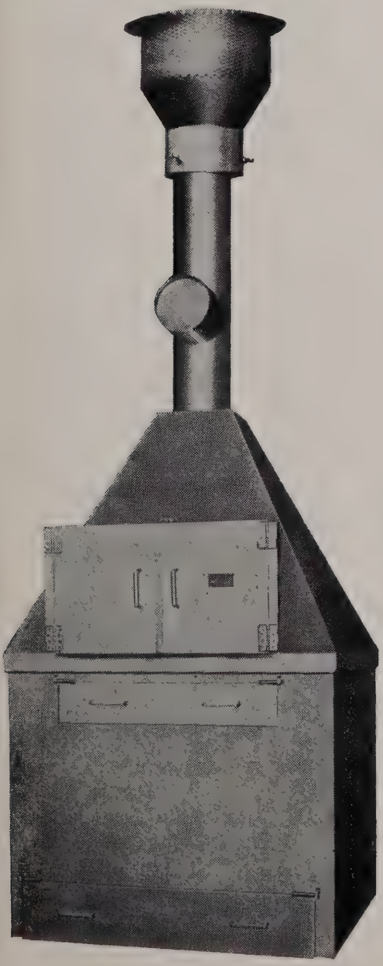
Consumption of Motor Spirit	14·23 million tonnes
Consumption of Derv Fuel	5·04 million tonnes

Pollutant	*Petrol Engines*	*Diesel Engines*
Carbon monoxide	6·7	0·11
Hydrocarbons	0·34	0·021
Aldehydes	0·01	0·003
Oxides of nitrogen	0·23	0·07
Oxides of sulphur	0·025	0·04

The estimated quantity of carbon monoxide discharged into the air from the other industrial and domestic uses of all fuels in the year 1970-71 is about 10 million tonnes including about 4 million tonnes from domestic heating appliances. These discharges are above ground level whereas the discharges from road vehicles are at ground level.

Lead

The quantities of lead in grammes in the lead alkyl compounds added to each litre of the several grades of petrol used in the United Kingdom during each of the years 1960 to 1970 are given in a useful paper by G. S. Parkinson published in the August 1971 issue of the Petroleum Review. From the figures in that paper it is estimated that the total amount of lead in the motor spirit used in the U.K. in 1970-71 was about 9,000 tonnes. The lead would be converted to complex inorganic compounds and about one-third would be retained partly in the lubrcating oil and partly in the exhaust system. This means that the amount of lead in the compounds discharged in the exhaust gases from petrol-driven vehicles in 1970-71 was about 6,000 tonnes.



PROGRESS REPORT ON CLEERBURN INCINERATORS

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Bradford City Council
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Durham County Council
Essex County Council
Galway County Council
Hertfordshire County Council
Hampshire County Council
Glamorganshire County Council
London Borough of Hounslow
London Borough of Newham
London Borough of Brent
Lincoln County Council
Monmouthshire County Council
Reading Borough Council
Shoreham by Sea UDC
City of Southampton UDC
Swindon Borough Council
Westmorland County Council
West Sussex County Council
Worcestershire County Council

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SMOKE CONTROL AREAS

Programmes and Progress

The following lists contain the names of local authorities in the "Black areas" with (1) the target date for completion of their smoke control programme (2) the final acreage when completed (3) acreage in operation on 30 June, 1972 (4) total number of premises in operation on 30 June, 1972.

The figures have been compiled directly from information obtained from the local authority concerned. Final acreage and target dates may differ from last year, or not be given, because of local government re-organisation. The figures are for the position at the 30 June, 1972—some authorities will have started, or increased, their smoke control since this date.

Bold type indicates completed programmes.

**Indicates figures at 31 December, 1970 as no returns were received.*

NORTHERN

	1 Target Date	*2 Final Acreage*	*3 Acreage (In Oper.) 30.6.72*	*4 Premises (In Oper.) 30.6.72*
Darlington C.B.	1983	6,775	622	3,734
Gateshead C.B.	—	4,559	1,177	9,677
Hartlepool C.B.	1977	11,280	3,958	15,772
Newcastle-upon-Tyne C.B.	1977	11,401	5,440	33,202
South Shields C.B.	1976	4,600	624	6,192
Sunderland C.B.	1977	13,391	1,938	10,462
Teesside C.B.	—	49,107	15,948	47,279
Tynemouth C.B.	1980	3,500	1,258	5,296
Jarrow B.	1974	2,200	236	1,208
Wallsend B.	1982	3,544	1,104	4,659
Blaydon U.D.	1978/80	9,325	519	1,970
Boldon U.D.	1976/77	7,344	2,898	3,487
Felling U.D.	1980	3,325	546	4,472
Gosforth U.D.	1978	1,739	168	771
Hebburn U.D.	1974	1,563	1,419	5,983
Hetton U.D.	—	—	—	—
Newburn U.D.	1980	4,648	999	6,709
Ryton U.D.	1981	5,145	—	—
Whickham U.D.	1977	6,213	1,892	4,736

NORTH WESTERN

	1 Target Date	*2 Final Acreage*	*3 Acreage (In Oper.) 30.6.72*	*4 Premises (In Oper.) 30.6.72*
Birkenhead C.B.	1976	8,643	3,116	18,293
Blackburn C.B.	1978	8,080	3,091	13,169
Bolton C.B.	1983	5,401	3,074	24,208
Bootle C.B.	1978	3,329	1,894	11,038
Burnley C.B.	**1972**	**4,695**	**4,695**	**34,928**
Bury C.B.	1975	3,165	2,305	9,021
Dudley C.B.	1980	13,151	6,899	31,474
Leicester C.B.	1975	18,141	12,269	59,346
Liverpool C.B.	1980	27,819	16,568	86,292
Manchester C.B.	1975	27,255	17,735	100,306
Oldham C.B.	1978	6,392	2,772	11,329
Preston C.B.	1984	6,357	2,509	14,771
Rochdale C.B.	1977	9,553	5,974	20,100
*St. Helens C.B.	1975	7,940	4,052	11,125
Salford C.B.	1972	5,202	4,840	51,508
Stockport C.B.	1977	8,440	2,687	19,991
Wallasey C.B.	1974	5,961	5,349	27,660
Warrington C.B.	1973	4,629	4,371	21,986
Wigan C.B.	1978	5,083	2,402	12,422
Accrington B.	1980	4,418	1,270	4,864
Altrincham B.	1975	3,497	1,348	6,447
Ashton-under-Lyne B.	1976	4,146	3,105	11,060
Bebington B.	1974	6,000	3,600	10,200
Colne B.	1974	1,150	673	4,720
Darwen B.	1982	5,000	1,198	3,088

North Western continued

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.72*	4 *Premises (In Oper.) 30.6.72*
Dukinfield B.	—	1,725	1,293	4,440
Eccles B.	1974	3,417	2,736	10,600
Ellesmere Port B.	1977	4,000	2,522	12,129
Farnworth B.	1978	1,504	612	3,357
Heywood B.	1973	8,342	8,248	10,802
Hyde B.	1974	4,170	3,326	10,724
Leigh B.	1979	6,359	4,027	8,031
Middleton B.	1980	5,170	2,610	9,155
Mossley B.	1979	2,000	54	589
Nelson B.	1973	2,056	1,602	11,916
Prestwich B.	1974	2,420	2,067	8,575
Radcliffe B.	—	4,915	1,824	4,506
Sale B.	1972	3,629	3,250	18,526
Stalybridge B.	1974	3,190	2,478	5,416
Stretford B.	1972	2,582	2,335	15,708
Swinton and Pendlebury B.	1975	3,363	1,479	7,169
Widnes B.	1978	5,000	2,775	10,180
Abram U.D.	—	1,984	—	—
Ashton-in-Makerfield U.D.	—	6,265	—	—
Aspull U.D.	—	1,906	—	—
Atherton U.D.	1974/75	2,265	1,899	4,828
Audenshaw U.D.	1978	1,241	729	1,528
Blackrod U.D.	1973	2,364	1,398	1,277
Bowdon U.D.	—	—	—	—
Bredbury and Romily U.D.	1980	4,295	522	2,042
Brierfield U.D.	1974	807	705	2,046
Chadderton U.D.	**1969**	**3,014**	**3,014**	**11,994**
Cheadle and Gatley U.D.	**1968**	**5,303**	**5,303**	**22,491**
Church U.D.	**1971**	**308**	**308**	**1,y83**
Clayton-le-Moors U.D.	1979	1,039	—	—
Crompton U.D.	1978	2,865	1,587	3,174
Denton U.D.	**1970**	**2,592**	**2,592**	**14,679**
Droylsden U.D.	1974	1,245	1,049	6,947
Failsworth U.D.	1974	1,663	1,191	5,500
Fulwood U.D.	1978	3,164	469	8540
Golbourne U.D.	—	7,548	2,362	737
Great Harwood U.D.	1973/74	2,868	2,530	2,313
Haydock U.D.	—	—	—	—
Hindley U.D.	1979	2,162	225	1,518
Horwich U.D.	1977	3,254	806	1,242
Huyton-with-Roby U.D.	1985	3,054	1,380	7,217
*Ince-in-Makerfield U.D.	—	—	—	—
Irlam U.D.	1974	4,717	4,129	5,023
Kearsley U.D.	1974	1,728	487	1,768
Kirkby U.D.	1974	2,736	1,957	17,163
Litherland U.D.	1978	1,187	482	1,403
Little Lever U.D.	—	808	140	366
Newton-le-Willows U.D.	—	—	153	534
Oswaldtwistle U.D.	1980	4,000	410	1,318
Padiham U.D.	1974	976	782	2,911
Prescot U.D.	—	875	124	1,141
Rishton U.D.	—	—	102	317
Royton U.D.	1972	2,149	1,796	6,181
Runcorn U.D.	1975	7,212	3,301	9,580
Tottington U.D.	1975	2,544	546	1,684
Tyldesley U.D.	1978	5,174	1,340	1,983
Urmston U.D.	1973	3,799	3,218	15,418
Westhoughton U.D.	1980	5,554	1,641	2,420
Whitefield U.D.	**1968**	**3,386**	**3,386**	**7,610**
Worsley U.D.	1976	7,242	2,830	10,843

YORKSHIRE AND HUMBERSIDE

Barnsley C.B.	1990	7,817	1,954	4,320
Bradford C.B.	1974	25,504	18,964	82,369
Dewsbury C.B.	1976	6,720	3,775	8,198
Doncaster C.B.	1977	8,371	4,621	19,047
Halifax C.B.	1978	14,081	3,703	21,686

Yorkshire and Humberside continued

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.72*	4 *Premises (In Oper.) 30.6.72*
Huddersfield C.B.	1980	14,147	5,847	25,370
Kingston Upon Hull C.B.	1984	17,599	7,916	36,177
Leeds C.B.	1975	40,613	22,412	96,213
Rotherham C.B.	1975	8,000	3,027	14,000
Sheffield C.B.	1972	45,363	42,563	180,000
Wakefield C.B.	1977	5,801	2,804	7,470
Batley B.	1979	4,457	1,101	5,283
Brighouse B.	1973	7,873	5,933	12,064
Castleford B.	—	4,394	32	512
Keighley B.	1974	23,611	4,924	13,600
Morley B.	1977	9,494	6.215	9,600
Ossett B.	**1968**	**3,332**	**3,332**	**6,362**
Pontefract B.	1982	4,865	981	2,153
Pudsey B.	1974	5,323	3,338	5,889
Spenborough B.	1973	8,253	6,381	13,568
Aireborough U.D.	**1971**	**6,856**	**6,856**	**12,040**
Baildon U.D.	**1972**	**2,830**	**2,830**	**6,325**
Bingley U.D.	1972	11,418	11,396	9,799
Conisborough U.D.	—	—	106	430
Cudworth U.D.	1975	1,746	123	436
Darfield U.D.	—	—	—	—
Darton U.D.	1989	4,718	553	703
Dearne U.D.	1987	3,888	1,364	1,476
Dodworth U.D.	—	—	—	—
Elland U.D.	1974	5,951	5,549	4,821
Featherstone U.D.	—	4,425	—	—
Heckmondwike U.D.	1974	696	546	2,839
Horbury U.D.	**1971**	**1,280**	**1,280**	**3,914**
Horsforth U.D.	1974	2,706	1,640	5,017
Hoyland Nether U.D.	1980	1,998	232	225
*Knottingley U.D.	1973	2,837	—	—
Mexborough U.D.	1980	1,452	248	748
Mirfield U.D.	1979	3,394	1,121	2,955
Normanton U.D.	—	3,061	56	754
Queensbury and Shelf U.D.	—	2,795	625	1,905
Rawmarsh U.D.	—	—	—	—
Rothwell U.D.	1974	10,695	4,260	6,148
Royston U.D.	1976	1,100	—	—
Shipley U.D.	**1971**	**2,184**	**2,184**	**10,494**
Sowerby Bridge U.D.	1974	5,763	2,287	4,547
Stanley U.D.	—	—	458	1,726
Swinton U.D.	—	1,718	813	2,088
Wath-Upon-Dearne U.D.	1975	2,677	898	1,836
Wombwell U.D.	1982	3,838	306	418
Worsbrough U.D.	—	—	—	—

EAST MIDLANDS

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.72*	4 *Premises (In Oper.) 30.6.72*
Derby C.B.	1979	19,282	8,454	27,989
Nottingham C.B.	—	18,364	7,568	26,729
Chesterfield B.	1985	8,468	1,400	4,931
Ilkeston B.	1984	3,017	1,305	3,605
Mansfield B.	1980/1	7,009	2,229	4,701
Alfreton U.D.	—	5,176	678	275
Arnold U.D.	1978	4,505	663	2,890
Beeston and Stapleford U.D.	1975	6,468	5,117	16,489
Bolsover U.D.	—	4,526	86	236
Dronfield U.D.	1974	3,457	2,148	3,082
Eastwood U.D.	—	—	—	—
Hucknall U.D.	—	4,029	1,338	1,493
Kirkby-in-Ashfield U.D.	1980/81	5,831	79	844
Long Eaton U.D.	—	3,557	37	448
Mansfield Woodhouse U.D.	1987	4,834	1,800	1,624
Staveley U.D.	1976	6,504	252	838
Sutton-in-Ashfield U.D.	—	10,507	1,838	4,131
West Bridgford U.D.	1977	3,045	*First order operative 1 November 1972*	

	1 Target Date	2 Final Acreage	3 Acreage (In Oper.) 30.6.72	4 Premises (In Oper.) 30.6.72
GREATER LONDON				
City of London	**1955**	**677**	**677**	**21,700**
Barking	1977	10,788	5,794	44,485
Barnet	1976	22,123	11,774	71,538
Bexley	1975	15,183	11,610	42,915
Brent	1973	10,927	7,695	72,500
Bromley	1977	37,583	12,237	57,324
Camden	**1968**	**5,364**	**5,364**	**87,303**
Croydon	1978	21,395	8,664	79,817
Ealing	**1972**	**13,708**	**13,708**	**91,057**
Enfield	—	20,061	16,820	74,250
Greenwich	**1972**	**11,724**	**11,724**	**75,673**
Hackney	**1967**	**4,814**	**4,814**	**90,507**
Hammersmith	**1967**	**3,950**	**3,950**	**72,559**
Haringey	**1968**	**7,491**	**7,491**	**84,683**
Harrow	1975	12,555	6,787	46,724
Havering	1980	29,650	11,659	81,000
Hillingdon	1978	27,258	14,538	41,439
Hounslow	1972	14,469	12,550	64,024
Islington	**1969**	**3,679**	**3,679**	**82,000**
Kensington and Chelsea (Royal)	1972	2,950	2,758	68,894
Kingston-upon-Thames (Royal)	1978	9,281	4,364	30,480
Lambeth	1976	6,726	3,950	68,980
Lewisham	—	8,579	8,182	84,500
Merton	1975	9,381	6,807	42,573
Newham	1977	8,986	2,447	31,125
Redbridge	**1971**	**13,983**	**13,983**	**67,658**
Richmond-upon-Thames	**1972**	**13,873**	**13,873**	**75,400**
Southwark	1975/76	6,981	4,652	68,543
Sutton	1976	10,732	4,762	32,261
Tower Hamlets	**1968**	**4,876**	**4,876**	**78,702**
Waltham Forest	1980	9,805	6,696	61,372
Wandsworth	1973	8,877	7,092	82,498
Westminster (City)	**1970**	**5,334**	**5,334**	**131,021**
WEST MIDLANDS				
Birmingham C.B.	1978	51,598	29,447	170,835
Coventry C.B.	1981	20,165	6,464	25,000
Solihull C.B.	1989	13,645	3,162	9,970
Stoke-on-Trent C.B.	1980	22,949	9,510	21,576
Walsall C.B.	1980	12,990	2,814	9,283
Warley C.B.	1993	9,471	1,781	14,358
West Bromwich C.B.	—	11,704	3,086	15,365
Wolverhampton C.B.	1986	17,004	4,514	25,133
Halesowen B.	1975	5,237	3,327	9,649
Newcastle-under-Lyme B.	1984	8,861	3,237	10,505
Stourbridge B.	—	—	1,700	9,500
Sutton Coldfield B.	1979	13,691	2,107	8,401
Aldridge-Brownhills U.D.	—	123,000	3,357	11,600
Bedworth U.D.	1980	7,820	2,191	4,240
Kidsgrove U.D.	—	4,137	715	1,893
SOUTH WESTERN				
Bristol C.B.	1979	26,350	7,519	28,697
Local Authorities outside the Black Areas who have started Smoke Control				
Burton-on-Trent C.B.	1981	4,222	470	3,140
Canterbury C.B.	—	4,810	200	649
Exeter C.B.	—	10,952	5,683	13,104
Lincoln C.B.	—	8,828	2,441	2,850
Luton C.B.	1980	10,695	3,549	17,958
Northampton C.B.	1983	19,952	1,702	—
Norwich C.B.	—	9,655	104	1,108
Oxford C.B.	1985	8,785	2,261	9,953
Reading C.B.	1985	9,106	2,560	10,822
Southampton C.B.	1982	12,058	1,781	9,420

Local Authorities outside the Black Areas who have started Smoke Control continued	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.72*	4 *Premises (In Oper.) 30.6.72*
Southport C.B.	1990	9,426	67	132
York C.B.	—	7,295	301	2,496
Aylesbury B.	1980	3,594	275	2,000
Bedford B.	1980	6,012	2,418	10,486
Cambridge B.	—	10,038	406	1,453
Chatham B.	1980	4,371	3,201	7,500
Cheltenham B.	—	—	861	2,006
Dartford B.	1976	4,292	3,139	11,623
Gillingham B.	—	11,123	8,313	12,628
Glossop B.	1977/8	3,324	822	3,319
Grantham B.	—	3,868	1,500	4,075
Gravesend B.	1980	4,619	686	2,500
Hemel Hempstead B.	—	7,193	3,131	—
High Wycombe B.	1976	6,500	3,422	13,064
King's Lynn B.	1972	425	384	1,279
Lancaster B.	1980	5,413	3,185	7,650
Leamington Spa (Royal) B.	1977	2,875	997	5,056
New Windsor (Royal) B.	1980	4,616	415	1,082
Peterborough B.	—	10,022	2,795	3,677
Rawtenstall B.	1985	9,528	43	47
Rochester B.	1980	4,505	3,182	12,417
Rugby B.	1984	7,010	2,869	8,463
Scunthorpe B.	1982	7,895	3,385	12,043
Shrewsbury B.	—	9,317	379	2,499
Slough B.	1978	6,202	3,079	15,427
Tamworth B.	1981	7,647	2,176	4,019
Todmorden B.	—	12,790	948	5,791
Warwick B.	—	—	147	975
Watford B.	1978	5,275	1,976	7,644
Whitley Bay B.	1978	3,612	2,041	5,954
Basildon U.D.	1977	—	4,128	19,207
Brentwood U.D.	—	—	227	2,856
Cheshunt U.D.	1979	8,480	1,181	7,462
Corby U.D.	1974/82	6,034	1,296	8,000
Crawley U.D.	1972	5,622	4,967	16,684
Hale U.D.	1978	2,264	178	1,625
Harlow U.D.	**1966**	**5,889**	**5,889**	**23,977**
Hazel Grove and Bramhall U.D.	1974	5,990	1,957	8,223
Heanor U.D.	—	142	—	861
*Kingswood U.D.	—	—	12	130
Leek U.D.	—	—	96	449
Letchworth U.D.	1982	5,083	1,103	3,419
Marple U.D.	1978	7,130	419	1,603
Northfleet U.D.	—	—	377	2,500
Old Fletton U.D.	—	—	134	1,060
Potters Bay U.D.	1981	3,500	1,415	3,777
Ramsbottom U.D.	1975	9,559	959	1,467
Ripley U.D.	—	—	191	529
Saddleworth U.D.	—	227	227	413
Saltburn and Marske-by-the-Sea U.D.	1974	4,082	1,890	584
Seaton Valley U.D.	1978	13,659	1,960	3,201
Skelmersdale and Holland U.D.	1978	7,537	3,169	6,581
Skipton U.D.	1974	4,211	1,359	2,935
Staines U.D.	**1972**	**8,271**	**8,271**	**23,720**
Stanley (Co. Durham) U.D.	—	—	458	1,726
Stocksbridge U.D.	1980	4,631	—	—
Swadlincote U.D.	1978	3,754	991	592
Thurrock U.D.	1982	7,776	2,056	12,984
Waltham Holy Cross U.D.	1978	1,077	299	930
Wellington (Salop) U.D.	1977	2,281	197	984
Wilmslow U.D.	—	7,691	293	2,566
Winsford U.D.	—	7,094	708	3,633
Belper R.D.	1973	855	734	188
Blaby R.D.	—	—	1,016	2,346
Blackburn R.D.	—	—	483	2,150
Castleward (Northumberland) R.D.	**1972**	**306**	**306**	**3,238**

Local Authorities outside the Black Areas who have started Smoke Control continued	*1* *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.72*	*4* *Premises (In Oper.) 30.6.72*
Chesterfield R.D.	1980	20,723	8,083	10,176
Darlington R.D.	1975/76	1,000	600	3,000
Dartford R.D.	1977	6,779	2,325	4,117
Easington R.D.	1977	2,700	—	—
Easthampstead R.D.	1975	3,286	180	1,086
Elstree R.D.	*In abeyance. To be reconsidered annually*		500	2,877
Flaxton R.D.	**1969**	**237**	**237**	**270**
Glanford Brigg R.D.	—	—	1,526 *First area operational 1/7/72*	489
Market Drayton R.D.	1979	800		
Meriden R.D.	1975	4,047	2,633	20,836
Runcorn R.D.	1977	8,100	379	1,085
*S.E. Derbyshire R.D.	—	—	11	122
Seisdon R.D.	1986	6,000	1,052	159
Skipton R.D.	1982	860	54	464
Warrington R.D.	1974	22,732	4,763	6,570
Wetherby R.D.	—	—	500	725
Whiston R.D.	1975	3,297	745	5,951
Wortley R.D.	—	48,124	1,075	3,915

WALES

Cardiff C.B.	*Mainly low volatile steam coal used*			
Merthyr Tydfil C.B.	—	—	—	—
*Newport C.B.	—	—	43	651
Swansea C.B.	—	—	—	—
*Neath B.	—	—	—	—
*Port Talbot B.	—	—	—	—
*Rhondda B.	—	—	—	—
Abercarn U.D.	*Mainly low volatile steam coal used*			
Aberdare U.D.	—	—	—	—
*Abertillery U.D.	—	—	—	—
*Bedwas and Machen U.D.	—	—	—	—
Bedwellty U.D.	—	—	—	—
Blaenavon U.D.	—	—	—	—
*Caerleon U.D.	—	—	—	—
Caerphilly U.D.	—	—	—	—
Cwmbran U.D.	—	—	—	—
Ebbw Vale U.D.	—	—	—	—
Gelligaer U.D.	—	—	—	—
*Glyncorrwg U.D.	—	—	—	—
Llwchwr U.D.	—	—	—	—
Maesteg U.D.	—	—	—	—
Mountain Ash U.D.	—	—	—	—
Mynyddisbwyn U.D.	—	—	—	—
*Nantyglo and Blaina U.D.	—	—	—	—
Ogmore and Garw U.D.	—	—	—	—
*Pontypool U.D.	—	—	—	—
*Pontypridd U.D.	—	—	—	—
*Rhymney U.D.	—	—	—	—
*Risca U.D.	—	—	—	—
Tredegar U.D.	—	—	—	—

Outside Black Areas (Wales)

Wrexham B.	1979	2,916	863	3,540
*Connah's Quay U.D.	—	—	53	—
Mold U.D.	—	1,160	108	450

SCOTLAND—Smoke Control Areas in Operation

Airdrie	1984	2,909	—	—
Alloa	1976	1,355	272	1,132
Barrhead	1975	1,154	599	3,834
Bearsden	1973	3,079	2,458	6,605
Bishopbriggs	1975	3,595	887	3,012
Clackmannan County	1976	2,095	370	1,694
Clydebank	1975	2,980	1,904	9,938

Scotland continued

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.72*	4 *Premises (In Oper.) 30.6.72*
Coatbridge	**1970**	**4,339**	**4,339**	**15,800**
Denny and Dunipace	—	906	112	714
Dumbarton Burgh	1974	3,420	1,732	6,092
Dundee	1980	12,294	6,282	40,817
East Kilbride	1972	6,658	6,003	19,687
Edinburgh	1982	34,731	8,189	28,632
Falkirk	1975	4,825	3,336	8,032
Fife County	—	—	3,732	4,429
Galashiels	1972	1,766	1,205	5,242
Glasgow	1979	39,725	23,793	154,950
Grangemouth	1980	4,725	673	4,632
Hamilton	1980	3,818	577	3,832
Hawick	1977	1,242	14	117
Johnstone	—	—	243	1,353
Kilmarnock	**1972**	**77**	**77**	**304**
Lanark County	—	—	1,372	8,724
Midlothian County	—	—	4,137	4,704
Milngavie	1975	1,848	291	179
Motherwell	1975	6,987	582	11,762
Paisley	1975	6,558	4,588	23,879
Port Glasgow	1973	1,461	1,210	5,070
Renfrew Burgh	1973	2,315	1,793	5,455
Renfrew County	1974	127,694	1,397	340
Rutherglen	1977	1,228	639	4,549
Stirling County	1976	—	5,792	12,347
West Lothian County	—	69,959	2,384	11

NORTHERN IRELAND—Smoke Control Areas in Operation

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.72*	4 *Premises (In Oper.) 30.6.72*
Antrim R.D.	—	—	72	772
*Armagh U.D.	—	—	—	—
*Ballymena B.	—	—	—	—
Belfast C.B.	1989	15,815	613	6,694
Castlereagh R.D.	1976	—	2,189	9,341
*Coleraine R.D.	—	—	—	—
Craigavon U.D.	1973	3,703	3,641	1,500
Downpatrick U.D.	—	—	482	486
Hillsborough R.D.	1976	—	507	1,167
Holywood U.D.	—	—	78	540
Larne B.	1976	2,381	11	290
Londonderry Dev. Comm.	1981	2,000	*Action restricted due to civil unrest*	
Lurgan B.	1980	2,400	334	2,526
Newtownabbey U.D.	1987	6,072	562	2,891
Newtownards B.	1976	243	105	435
*Portadown B.	—	—	85	613

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND
at 30th June 1972
(Figures supplied by the Department of the Environment)

(1) *Region*	*(2)* *No. of black area acres covered by smoke control and smokeless zones orders confirmed or awaiting decision*	*(3)* *Percentage* of total black area acreage in region covered*	*(4)* *No. of black area premises covered by smoke control and smokeless zones orders confirmed or awaiting decision*	*(5)* *Percentage* of total black area premises in the region*
Northern	47,103	37·6	193,874	35·1
Yorks & Humberside ...	226,418	60·1	744,498	63·7
East Midlands	79,087	29·5	236,472	46·2
Greater London	271,522	83·0	2,312,780	87·6
North West	221,661	55·3	925,773	54·4
West Midlands	97,133	39·0	437,518	41·6
South West	7,505	28·5	28,695	19·3
Total (black areas)	950,429	53·5	4,879,610	62·7
Outside black areas... ...	191,777		532,201	
Grand Totals...	**1,142,206**		**5,411,811**	

*The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke control orders (e.g.: there may be some areas of open country).

Major Smog Disasters

The word "smog" was first used by the late Dr. H. A. Des Vœux, founder, president of the N.S.A.S. in 1905, to denote the combination of smoke and natural fog that in urban areas may have disastrous consequences. There are numerous cases of smog conditions resulting in a marked rise in mortality and morbidity from respiratory disorders and consequential cardiac failure. Among these incidents are the following:

London, 1873. Rise in bronchitis deaths, compared with the previous week, of 268.

London, 1880. Rise in bronchitis deaths, compared with the previous week, of 692.

London, 1891. Rise in bronchitis deaths, compared with the previous week, of 572.

Glasgow, 1909. Average number of deaths in the three weeks prior to the fog were 57 per week. During five weeks of fog or haze the deaths per week were: 138, 233, 171, 198 and 137.

Manchester and Salford, 1930-31. In December, with no fog, there were 137 respiratory disease deaths. In January there were nine days heavy fog and 592 deaths.

Meuse Valley, 1930. 60 deaths attributed to fog, the death rate rising to 10·5 times the normal. Many cattle had to be slaughtered.

London, 1948. Bronchitis deaths in week before fog, 73; in the week of fog, 148.

Donora, U.S.A., 1948. 18 deaths in a population of 14,000. 42 per cent of the population were estimated to have suffered from illness.

London, 1952. The fog developed on Friday, 5 December and continued until 8 December. Estimated total of 4,000 deaths in the Greater London area. In the Administrative County only deaths from bronchitis rose from 121 to 872, and from heart and circulatory diseases, from 318 to 801.

London, 1956. 1,000 additional deaths attributed to January fog in the Greater London area. (*B.M.J.*, 31 March, 1956.)

London, 1962. Fog in London and other areas, December 3-7, with similarities to the 1952 fog, but with 750 additional deaths as compared with 4,000.

Principal References

Mortality and Morbidity during the London Fog of December, 1952. Ministry of Health Public Health Report No. 95. (This report contains a section on "Previous Fog Incidents", with a statistical appendix for those in London.)

Les Problèmes de Pollution de l'Atmosphère, Batta, Firket and Leclerc, Liége, 1937.

Air Pollution in Donora, Pa. Public Health Bulletin, No. 306, Federal Security Agency, Public Health Service, Washington.

DUST—WESTERN PRECIPITATION

world leaders in dust control for over half a century

Western Precipitation design and manufacture all four basic types of Dust and Fume Control Equipment. With this background we are able to help you establish the most efficient and economic solution to your problem.

1. Electrostatic Precipitators:

Western Precipitation pioneered the Cottrell process of electrically precipitating dust, fume, fly-ash and other suspensions from gases. Plants can be designed to handle virtually any gas volume from a few thousand to millions of cubic feet per minute of gas, with collecting efficiencies in excess of 99.9%.

2. Therm-O-Flex (R) High Temperature Bag Filters:

Therm-O-Flex filter systems clean gases with inlet temperatures as high as 600°F with virtually 100% collection efficiency. Our silicon treated woven glass filter sleeves are cleaned automatically by intermittent collapsing and, with minimum moving parts, service and maintenance are kept to a minimum. Therm-O-Flex filters are suitable over a wide range of applications.

3. Multiclone (R) Mechanical Collectors:

Several exclusive design features make the Multiclone collector the finest and most durable small tube cyclone collector available. Our standard 9" and 12" diameter cast iron tubes incorporate the best features of high efficiency, low maintenance and high gas capacity, combined with flexibility in plant size, to save space and simplify ductwork. The Multiclone has been successfully applied to dust collecting problems in many industries, including Power, Cement, Chemical, Coal and Rock Products.

4 & 5. Dust Valves:

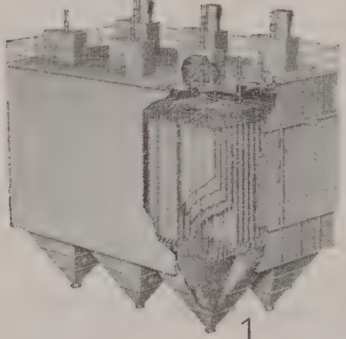
The gravity operated cast-iron tipping valve (also available in the motorized design, type R-1) is ideal for sealing dust hoppers when handling dry, free-flowing material. The airlock principle is achieved in these valves by the use of 2 flaps that operate alternately, permitting the collected material to pass out of the hopper without pressure loss. The floating seal rotary valve has an ingenious metal to metal seal and is ideal for handling abrasive materials at high temperatures.

6 & 7. Turbulaire (R) Gas Scrubbers:

Turbulaire scrubbers offer many important advantages where high efficiency, long life and maximum corrosion resistance are essential. The unique jet action principle ensures low water consumption and, with no moving parts or fine nozzles to block, minimum maintenance is required. Three designs are available, manufactured in a variety of materials to suit most applications.

8. Joy Microdyne (R) Scrubber:

The Joy Microdyne scrubber is a compact in-line unit, one-tenth to one-twentieth the size of other collectors. It has a high collecting efficiency, Is available with water re-circulation, and can be installed direct into a duct system. It is available for gas volumes between 2,500 and 64,000 cfm. and is constructed in mild or stainless steel. Its high efficiency and small size make it particularly useful in underground mining operations.



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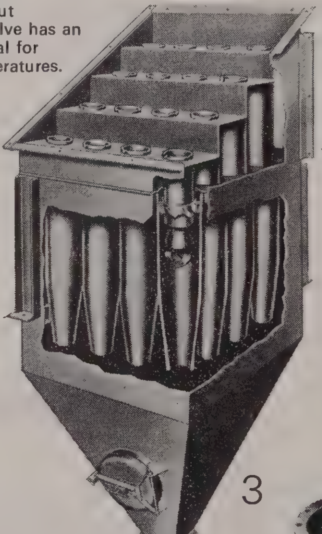

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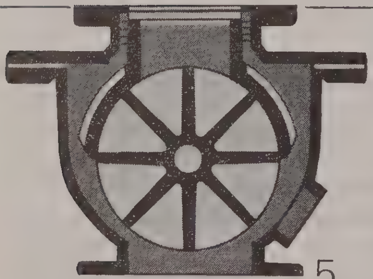

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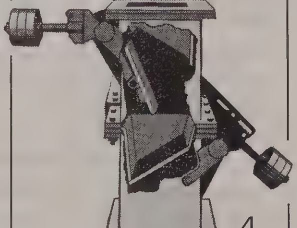

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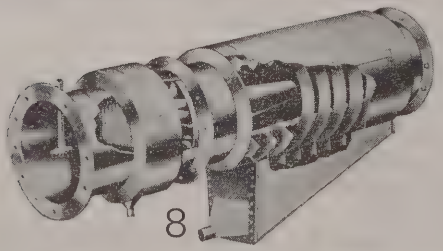
Western Precipitation

Division of Joy Manufacturing Co.
(UK) Ltd. Capitol House · Church St.
Epsom · Surrey.
Tel: Epsom 27661 Telex: 23704



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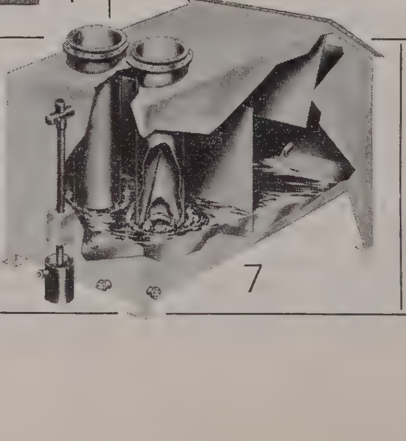

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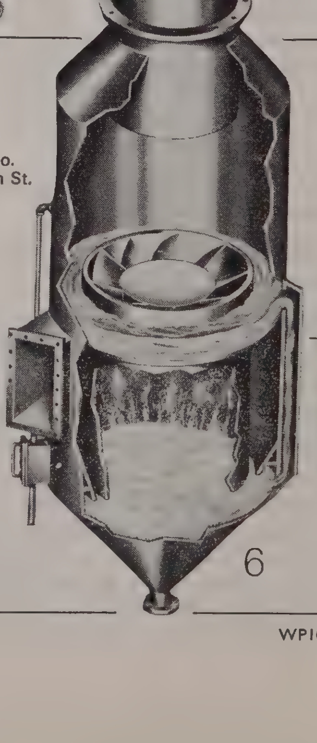

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WP10

AN OUTLINE OF THE LAW RELATING TO AIR POLLUTION

The control of air pollution in Great Britain is essentially a team effort involving Local Authorities, the Department of the Environment (including the Alkali Inspectorate), Police Authorities (in respect of road vehicle emissions) and the Factory Inspectorate (in respect of dusts and toxic fumes, etc., in factory atmospheres).

The principal legislation enforced by local authorities in Great Britain (excluding Northern Ireland) is contained in the Clean Air Acts 1956 and 1968, but some of the "nuisance" provisions of the Public Health Act 1936, extended and amended by the Public Health Act 1961 and the Public Health (Recurring Nuisances) Act 1969, are applicable in specified circumstances. The domestic smoke control area provisions of the Clean Air Act 1956 were amended by section 95 of the Housing Act 1964 and further amended by the Clean Air Act 1968.

The provisions of the Clean Air (Northern Ireland) Act of 1964 are largely identical to those of the 1956 Act.

The control of "noxious or offensive gases" from some 59 different classes of works registrable under the provisions of the Alkali &c. Works Regulation Act 1906 and the Alkali &c. Works Order 1966 is exercised by the Alkali Inspectorate of the Department of the Environment (see the section on page 40 on the Alkali &c. Works Regulation Act).

Action may also be taken under Common Law procedure by anyone who suffers nuisance from air pollution, and in this way it may be possible to secure damages and/or to obtain an injunction.

There are also a number of Private Acts of Parliament in which some local authorities possess powers to deal with smoke emission, to establish smokeless zones and to grant optional prior approval of proposed new industrial fuel burning installations. Most of these provisions, although they may remain in force, have now been superseded by the provisions of the Clean Air Acts 1956 and 1968. The control of pollution from road vehicles is exercised by the police under the provisions of the Road Traffic Acts and the Motor Vehicles (Construction and Use) Regulations 1969, a note of which is to be found on a later page.

The following outline of current legislation, which necessarily omits much detail, gives the main provisions of the Clean Air Acts 1956 and 1968 and supporting Acts under the main subjects of "smoke", "chimney heights", "grit, dust and fume" and "miscellaneous provisions".

1. THE CONTROL OF SMOKE

A Definition of "dark" and "black" smoke:

Where legal standards of emission are prescribed for smoke, they refer to "dark" and "black" smoke. These are defined in the 1956 Act, and in Regulations, by reference to a shade on the British Standard Ringelmann Chart (see page 45) as:

> "Dark" smoke (defined in S.34 of the 1956 Act) means smoke which if compared . . . with the Ringelmann Chart would appear to be as dark as or darker than shade 2 on the chart.
>
> "Black" smoke (defined in the Dark Smoke (Permitted Periods) Regulations 1958; and in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 means smoke which, if compared . . . with the Ringelmann Chart, would appear to be as dark as or darker than shade 4 on the chart.

B Use of Aids in Assessing Smoke Colour:

Although legislation defines dark and black smoke by reference to colour shades on the Ringelmann Chart, the use of the Chart is not compulsory. S.34(2) of the 1956 Act says that "For the avoidance of doubt, it is hereby declared that . . . the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type."

C Design Standards for New Plant

Section 3 of the Clean Air Act 1956 requires all new furnaces (other than domestic boilers with a rating less than 55,000 Btu/hr.) to be, so far as practicable, capable of operating continuously without emitting smoke when burning fuel of a type for which the furnace was designed.

There is no definition of "furnace", but a practical interpretation of this word wherever it appears in Clean Air legislation, is usually taken as "any enclosed or partly enclosed space in which liquid, solid or gaseous matter is burned, or in which heat is produced".

It is a requirement of this section that the proposed installation of all new furnaces (other than domestic boilers rated at less than 55,000 Btu/hr.) *must* be notified to the local authority, and if one wishes to do so, one may apply for local authority approval that the proposed unit is capable of substantially smokeless operation. The approval does not, however, allow indiscriminate smoke emission and the furnace must be operated to ensure that permissible emissions are not exceeded.

D Standards for Smoke Emission:

Section one of the Clean Air Act 1956 prohibits the emission of dark smoke from a chimney, but also allows the Secretary of State for the Environment to make regulations exempting prescribed lengths of emission from possible action under this section.

The "permitted emissions" are prescribed in the Dark Smoke (Permitted Periods) Regulation 1958: and the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958.

D(1) The Dark Smoke (Permitted Periods) Regulations 1958 (Statutory Instrument 1958 No. 498)

(*a*) **Aggregate emissions of dark smoke.**

Number of furnaces served by the chimney	*Permitted emission of dark smoke in any period of eight hours*	
	If not soot blowing during period	*If soot blowing during period*
One	10 mins.	14 mins.
Two	18 mins.	25 mins.
Three	24 mins.	34 mins.
Four or more	29 mins.	41 mins.

Where a single boiler or unit of industrial plant is fired by more than one furnace discharging into the same chimney, those furnaces shall be deemed to be one furnace.

(*b*) **Continuous emissions of dark smoke**

The continuous emission of dark smoke in excess of four minutes, caused otherwise than by soot blowing, is prohibited.

(*c*) **Aggregate emission of black smoke**

No emission of black smoke exceeding two minutes aggregate in any period of thirty minutes is allowed.

There are thus three standards of emission which are acceptable in relation to any one chimney. The penalty for an offence under section one of the Act is a fine not exceeding £100 for each day on which the offence occurs.

D(2) The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (Statutory Instrument 1958 No. 878)

By the provisions of section 20 of the 1956 Act, vessels in waters not navigable by sea-going ships and in certain waters within the seaward limits of the territorial waters of the United Kingdom, must comply with the dark smoke provisions of section one of the 1956 Act, subject to the permitted emissions contained in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958, as follows:—

Class of Case	*Permitted Period for Emission of Dark Smoke*
1. Emissions from a forced draught oil-fired boiler furnace, or an oil engine.	10 minutes in the aggregate in any period of 2 hours.
2. Emission from a natural draught oil-fired boiler furnace (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
3. Emissions from a coal-fired boiler furnace:—	
(*a*) when the vessel is not under way (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
(*b*) when the vessel is under way.	20 minutes in the aggregate in any period of one hour.
4. Emissions from a natural draught oil-fired boiler furnace or a coal-fired boiler furnace in the following cases:—	
(*a*) a vessel with funnels shortened for the purpose of navigating the Manchester Ship Canal; (*b*) a tug not under way, but preparing to get under way or supplying power to other vessels or to shore installations; (*c*) a vessel not under way but using main power for the purpose of dredging, lifting, pumping or performing some other special operation for which the vessel is designed.	20 minutes in the aggregate in any period of one hour.
5. Emissions from any other source.	5 minutes in the aggregate in any period of 1 hour.

A vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground shall be deemed to be under way. The Regulations include a proviso that:

(*a*) **continuous emissions of dark smoke caused otherwise than by the soot blowing of a water tube boiler shall not exceed**
- (i) in the case of classes 1 and 2, 4 minutes;
- (ii) in the case of natural draught oil-fired boiler furnaces in class 4, 10 minutes; and
- (iii) in no case shall black smoke be emitted for more than 3 minutes in the aggregate in any period of 30 minutes.

D(3) Defences for excessive dark and black smoke emission

Section one of the 1956 Act contains three defences which may be available if an occupier of premises is proceeded against for dark/black smoke emission. These briefly are that the emission was:—

(*a*) solely due to lighting a furnace from cold and all practicable steps had been taken to minimise emissions.
(*b*) solely due to unavoidable mechanical failure of part of the plant and the contravention could not have been prevented after failure occurred.
(*c*) solely due to the unavoidable use of unsuitable fuel, suitable fuel not being available and the best available fuel being used; and all practicable steps were taken to minimise the emission.
(*d*) due to any combination of (*a*), (*b*) and (*c*).

N.B. That these are not absolute defences and are available only if every practical effort is made to avoid and/or minimise emissions.

E **Emissions of Dark Smoke from "Bonfires", etc.**

On 1st October 1969 Section one of the Clean Air Act 1968 became operative. This section prohibits (subject to prescribed exemptions) the emission of dark smoke from industrial or trade premises (as distinct from chimneys) and is concerned mainly with preventing excessive smoke emission caused by the indiscriminate burning of industrial or trade refuse in the open, but this section will also control dark smoke emissions from industrial processes not having a chimney.

In this connection, "industrial or trade premises" means premises normally used for industrial or trade purposes, or premises not normally so used, but which, at the time of the offence, were being used for industrial or trade burning.

The Secretary of State has made the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 which exempt the emission of dark smoke caused by the burning of the following materials, subject to the specified conditions:—

Exempted Matter

(1) *Matter*	(2) *Conditions*
1. Timber and any other waste matter (other than natural or synthetic rubber or flock or feathers) which results from the demolition of a building or clearance of a site in connection with any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961).	Conditions A, B and C.
2. Explosive (within the meaning of the Explosives Act 1875) which has become waste; and matter which has been contaminated by such explosive.	Conditions A and C.
3. Matter which is burnt in connection with (*a*) research into the cause or control of fire or (*b*) training in fire fighting.	Condition C.
4. Tar, pitch, asphalte and other matter which is burnt in connection with the preparation and laying of any surface, or which is burnt off any surface in connection with resurfacing, together with any fuel used for any such purpose.	Condition C.
5. Carcases of animals or poultry which (*a*) have died, or are reasonably believed to have died, because of disease; (*b*) have been slaughtered because of disease; or (*c*) have been required to be slaughtered pursuant to the Diseases of Animals Act 1950.	Conditions A and C, unless the burning is carried out by or on behalf of an inspector (within the meaning of Section 84 of the Diseases of Animals Act 1950).
6. Containers which are contaminated by any pesticide or by any toxic substance used for veterinary or agricultural purposes; and in this paragraph "container" includes any sack, box, package or receptacle of any kind.	Conditions A, B and C.

The conditions referred to in column 2 are:—

CONDITION A That there is no other reasonably safe and practicable method of disposing of the matter.
CONDITION B That the burning is carried out in such a manner as to minimise the emission of dark smoke.
CONDITION C That the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on his behalf.

F **Smoke Control Areas:**

Sections 11 to 15 of the Clean Air Act 1956, Sections 8 to 10 of the 1968 Act and Section 95 of the Housing Act 1964 relate to Smoke Control Areas, the administrative procedures, and the enforcement of Smoke Control Orders.

Section 11 of the 1956 Act allows a Local Authority to make a Smoke Control Order which must be submitted to the Secretary of State of the Environment for confirmation. When operative it is an offence for an occupier of premises to allow smoke emission from a chimney, unless the smoke is caused by the use of an "authorised fuel"; or the "fireplace" which the chimney serves is exempt from the Order.

The Clean Air (Authorised Fuels) Regulations 1956, 1963, 1965, 1969, 1970 (No. 2), 1971, 1971 (No. 2), 1971 (No. 3) and 1971 (No. 4) allow the use of the following fuels in Smoke Control Areas, even though some may for short periods cause light smoke emission:—

Anthracite	
Low Volatile Steam Coal	
Phurnacite Ovoids	Manufactured solid smokeless fuels
Coalite, Rexco and Rexco Ovoids	
Gloco and Gas Coke	
Homefire and Roomheat	
Multiheat	
Sunbrite and 'hard' coke	
Cosiglow	
Maxiglow	
Fireglo briquettes	
Ancit briquettes	
Extracite ovoids	
Syntraciet ovoids	
XL briquettes	
Anthracine ovoids	
Anthrite ovoids	
Gas and Electricity	

Other solid fuels are at various times submitted to the Department of the Environment for testing to determine whether or not they might become "Authorised Fuels" for use in Smoke Control Areas.

The Smoke Control Areas (Exempted Fireplaces) Orders 1970, 1970 No. 2, 1971, 1972 and 1972 (No. 2) conditionally exempt the emission of smoke from chimneys serving the following fireplaces:—

Class of Fireplace	*Conditions*
A. **1970 Order**	
1. Any fireplace specially designed or adapted for combustion of liquid fuel.	
2. Any fireplace (other than a fireplace fired by pulverised fuel) constructed on or after 31st December 1956 and installed before 1st May 1970 and equipped with mechanical stokers, or adapted between those dates for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
3. Any fireplace designed to burn coal (other than a fireplace fired by pulverised coal) with a heating capacity exceeding 150,000 Btu/hr. constructed and installed on or after 31st December 1956 and equipped with mechanical stokers or adapted on or after that date for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
4. The fireplace known as the Solid Fuel Ductair Unit, manufactured by Radiation Limited.	
5. The fireplace known as the Fulgora Slow Combustion Stove, manufactured by Fulgora Stoves Limited.	No fuel shall be used other than wood waste in clean condition.
6. The fireplace known as the Housewarmer, manufactured for the National Coal Board by Ideal Standard Limited.	No fuel shall be used other than washed coal singles.
7. The fireplace known as the Wood Chip Fired Air Heater, manufactured by Air Plants Ltd.	No fuel shall be used other than clean wood waste of a size within the limits referred to in the manufacturer's instructions.
8. The fireplace known as the Hounsell Sawdust Burning Stove, manufactured by John Hounsell (Engineers) Limited.	No fuel shall be used other than wood waste in clean condition.
B. **1970 (No. 2) Order (S.I. 1970 No. 1667)** The fireplace known as the Triancomatic T.80.	No fuel shall be used other than selected washed coal singles.
C. **1971 Order (S.I. 1971 No. 1265)** The fireplace known as the Rayburn CB34.	No fuel shall be used other than selected washed coal singles.
D. **1972 Order (S.I. 1972 No. 438)** The fireplace known as the Parkray Coalmaster.	No fuel shall be used other than selected washed coal singles.
E. **1972 (No. 2) Order (S.I. 1972 No. 955)** The fireplace known as the Trianco TGB 17.	No fuel shall be used other than selected washed coal singles.

In addition to the conditions above two standard conditions require all appliances to be installed, maintained and operated

(i) so as to minimise the emission of smoke;

(ii) in accordance with the manufacturer's instructions as to the operation (if any) of the appliance or, in the case of the class of fireplace numbered 6 above, in accordance with such instructions of the National Coal Board.

The local authority may also include in the Smoke Control Order other exemptions, which they may feel are necessary, subject to reasonable conditions. One of these is to allow the lighting of domestic fires with sticks and paper if there is no gas in the dwelling.

Thus, coal, oil and waste wood may not normally be burnt either by a householder or an industrialist unless on an exempted appliance, the design of which has satisfied the Secretary of State that it is capable of being operated substantially smokelessly and is exempted by Statutory Instrument.

The 1968 Act extended the Smoke Control provisions of the 1956 Act. The Minister is now empowered to require a local authority to make Smoke Control Orders. It is also an offence to acquire or to sell by retail for delivery in a Smoke Control Area any fuel other than an authorised fuel, unless in each case the premises or fireplace are exempt.

The financial provisions of the 1956 Act require the local authority to pay to owners or occupiers of dwelling houses a grant of 7/10ths of the reasonable cost of fireplace adaptations, and they may repay all or any part of the remaining 3/10ths. The local authority recovers 4/7ths of the grant from the Exchequer. A grant is not available in respect of a "new dwelling" begun on or after 16th August 1964.

The Housing Act 1964 allows a local authority to "designate" as unsuitable any appliances for which suitable fuels are not fully available, and in those circumstances a grant is not available for installation of those appliances.

Section 10 of the 1968 Act prevents a local authority from postponing the operation of a Smoke Control Order by more than 12 months.

Grant Arrangements

The principles which local authorities must follow in assessing eligibility of works of adaptation for grant are contained in the Memorandum on Smoke Control Areas revised by the Department of the Environment Circular 51/65. In Circular 32/71 the Department set cost limits for local authority guidance in assessing "reasonable costs":—

Smoke Control Area Grants: Cost Limits for Various Appliances (Circular 32/71)

	£
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar)	10
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar) with boiler	22*
Underfloor draught fire and fan assisted open fire	20
Underfloor draught fire and fan assisted open fire with boiler	30*
Solid fuel room heater	35
Solid fuel room heater with boiler	45*
Gas room heater	32
Electric thermal storage heater	35
Direct acting electric space heater	22
Oil room heater	32
Solid fuel cooker with boiler	80
Gas or electric cooker	48
Independent solid fuel boiler, **including installation**	32
Gas water heater (e.g. gas circulator and back boiler unit), **including installation**	32
Electric immersion water heater, **including installation**	22
Wash boiler, gas and electric	20
Gas poker, including flex and tap	3
Bottled gas igniter, if gas container is hired	4
Bottled gas igniter, including purchase of gas container	8
Electric kindler	10

*£3 may be added where

(i) it would be impossible or inadvisable to connect the existing boiler to the new space-heating appliance, and

(ii) either

(*a*) the existing boiler is itself bower-barffed or made of stainless steel, copper, aluminium, bronze or other superior material, or

(*b*) one of the above types is necessary to comply with local water bye-laws.

It is for the local authority to decide, within the appropriate level, what costs are reasonable in each case. In general the Department of the Environment will not accept as eligible for grant any expenditure which exceeds the stated limit.

G Statutory Procedure in the Event of an Offence for Excessive Smoke Emission

Section 30 of the 1956 Act requires the local authority authorised officer (usually the Public Health Inspector) to notify "as soon as may be" the occupier of the premises of the offence and to confirm his notification in writing within 48 hours of becoming aware of the offence.

This requirement applies to a contravention of Section one and eleven of the 1956 Act, i.e. Dark/Black smoke emission, and smoke emission in a smoke control area, and to Section one of the 1968 Act, i.e. dark smoke emission from industrial or trade burning. In any subsequent proceedings it is a defence to prove that the notification was not made "as soon as may be" or that the notification was not confirmed within two days following the date of offence.

H Statutory Smoke Nuisance:

Part III of the Public Health Act 1936 defines certain statutory nuisances, and prescribes the legal procedure for enforcing their abatement.

Section 16 of the Clean Air Act 1956 extends the provisions of Part III of the Public Health Act 1936, to include smoke nuisance, but a smoke nuisance cannot include:—

(i) smoke emitted from a chimney of a private dwelling, or
(ii) dark smoke from a chimney of a building or boiler or other plant (controlled by Section 1 of the 1956 Act), or
(iii) dark smoke caused by industrial or trade burning (controlled by Section 1 of the 1968 Act).

Where a smoke nuisance exists, the local authority may pursue the lengthy and cumbersome nuisance procedure, but if they are satisfied that the nuisance has occurred, has temporarily ceased, but is likely to recur, they may, without serving an Abatement Notice, cause a complaint to be made to the Magistrate's Court for the making of a Nuisance Order, following which the provisions of Part III of the Public Health Act 1936 for enforcement of the Order will apply.

Summary of the provisions relating to smoke emission

1. New plant must be capable of substantially smokeless operation.
2. The proposed installation of new furnaces must be notified to the local authority.
3. There are permitted periods for dark and black smoke emission from chimneys, and these standards apply throughout England and Wales.
4. The Permitted Periods Regulations apply whether or not premises are subject to a Smoke Control Order, but additionally, if in a Smoke Control Area, the occupier must ensure that smoke emission is prevented, or, where plant or premises are conditionally exempted, he must ensure that smoke emission is minimised.
5. A grant of 7/10ths of reasonable expenditure is available for the adaptation or replacement of domestic coal burning and similar open fires in a Smoke Control Area.
6. Dark smoke emission from bonfires, etc., on industrial or trade premises is, subject to exemptions, prohibited.
7. The authorised officer must notify the occupier of premises as soon as may be of the existence of an offence, and must confirm his notification in writing within 48 hours.
8. Smoke, other than smoke emitted from a dwelling, dark smoke from a chimney or dark smoke from industrial or trade burning, may if it causes a nuisance be regarded as a Statutory Nuisance under the Public Health Acts.

2. THE CONTROL OF CHIMNEY HEIGHTS

At whatever height smoke and flue gases are discharged, gravity will eventually bring the larger particles of grit, dust and soot to the ground. Additionally, because of the natural turbulence of the atmosphere, a proportion of the gases and of the freely suspended fine particles will reach the ground although not affected by gravity. The higher the point of discharge and the greater the total heat content of the discharge gases, the more widespread and diluted will be the fine particles and gases by the time they reach ground level.

The Legal Control of Chimney Heights

The legal control of chimney heights enables the local authority to take into account a number of relevant factors in determining the height of a chimney to avoid down draught or down wash created by the chimney itself, by buildings or topographical features, and to avoid the ground level concentration of the products of combustion from becoming prejudicial to health or a nuisance, or in the case of smaller units to prevent the flue gases from entering nearby buildings in too high a concentration. All chimneys must comply with the structural requirements of the Building Regulations 1972, but the control of the height or position of the terminal is now exercised under the provisions of the Clean Air Act 1968 or the Building Regulations 1972, according to the fuel consumption of the plant served by the chimney. Further control is available in the Public Health Act 1961 when a new building is proposed which will over-reach the chimney of an adjacent building and affect the dispersal of the products of combustion.

A The Clean Air Act 1968—Section 6

This section of the 1968 Act amends and extends the provisions of Section 10 of the Clean Air Act 1956, which it has largely replaced (except to control the height of chimneys serving non-combustion processes).

Whereas by Section 10 of the 1956 Act a local authority could control a chimney height only if building plans indicating a proposal to erect a chimney were submitted for approval, it must now, under the new provisions, consider a chimney height when:—

(i) a new chimney is erected to serve a new or existing furnace,
(ii) a furnace served by an existing chimney is enlarged, i.e. when its combustion space is increased, e.g. by the addition of a new furnace to an existing range of furnaces,
(iii) a furnace served by an existing chimney is removed and replaced by one having a larger combustion space,

but only if the furnace:—

(*a*) burns or is to burn pulverised fuel; or
(*b*) burns or is to burn at a rate of 100 lbs. or more an hour any other solid matter; or
(*c*) burns or is to burn at a rate equivalent to 1¼ million Btu or more per hour any liquid or gaseous matter.

An application for chimney height approval should preferably be on the form prescribed in the Clean Air (Heights of Chimneys) (Prescribed Form) Regulations 1969 (Statutory Instrument 1969 No. 412) but this does not preclude the local authority from considering an application even though not on the prescribed form, if the information provided by the applicant is sufficient.

The local authority must consider an application and give a written decision within 28 days of receiving the application, unless it is agreed in writing between the local authority and the applicant that a longer period may be allowed; the local authority, however, must not approve the proposed chimney height unless they are satisfied that it will be sufficient to prevent, so far as is practicable, the smoke, grit, dust, gases or fumes emitted from the chimney from becoming prejudicial to health or a nuisance, having regard to:—

(i) the purpose of the chimney,
(ii) the position and descriptions of buildings near to it,
(iii) the levels of the neighbouring ground,
(iv) any other matters requiring consideration in the circumstances.

Any approval of the height of a chimney may be granted unconditionally or subject to conditions as to the rate and/or quality of emissions from the chimney.

> "rate of emission" is defined as the quantities of any specified substance which may be emitted in a period specified in the conditions attached to the approval, e.g. lbs./hr. of sulphur dioxide.

Many other miscellaneous emissions may, of necessity, be considered for inclusion in conditions as to the rate of emission, but there will be cases where a limitation on "rate" alone will not sufficiently ensure against excessive pollution by materials other than normal combustion products, and in those cases it might be appropriate to impose conditions as to the "quality" (i.e. concentration) of the emission.

A limitation on the quality of emission would be appropriate if the products of combustion contain gases or acid mists resulting from abnormal reactions or breakdown of materials derived from chlorinated or sulphur bearing compounds, etc., or if products of combustion are mixed with waste gases from non-combustion processes.

There will also be occasions, particularly in relation to metallurgical processes, where the optical density of emissions may be regulated by reference to percentage obscuration or perhaps by reference to the Bacharach scale.

If a local authority fails to give a written decision within 28 days, the approval applied for is deemed to be granted without qualification.

If the local authority decide not to approve the height of a chimney or to attach conditions to their approval, they must give the applicant a written notification of their decision, stating their reasons, and they must additionally specify the lowest height, if any, which they are prepared to approve unconditionally and/or the lowest height they are prepared to approve with any specified conditions. The applicant may, within 28 days, appeal against the decision to the Secretary of State for the Environment, or the Secretary of State for Wales or for Scotland as appropriate.

In the event of an appeal being lodged, the Secretary of State may confirm the decision against which the appeal is made, or may amend the height or conditions as he thinks appropriate. He must also give a written notification of his decision stating his reasons and, where he does not approve a chimney height, specifying what height, with and/or without conditions, he would approve.

It is not necessary to apply for chimney height approval for any exempted boiler or plant, and the Secretary of State has made the Clean Air (Heights of Chimneys) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 411).

These Regulations provide in substance that chimney height approval is not required where a boiler or plant is used:—

(i) as temporary replacement for a boiler or plant which is under inspection or being maintained, repaired, rebuilt, or replaced by another permanent boiler or plant;
(ii) as a temporary source of heat or power for building or engineering construction work;
(iii) as a temporary source of heat or power for investigation or research;
(iv) as an auxiliary plant used to bring other plant to an operating temperature;
(v) as a mobile or transportable source of heat or power for agricultural operations.

Although a boiler or plant, when used wholly for one of the prescribed purposes, is exempt from the provisions requiring the height of the chimney to be approved, it is nevertheless subject to the other relevant provisions of the Clean Air Acts, and to the nuisance provisions of the Public Health Act 1936.

The Practical Determination of the Height of Chimneys Controlled Under the Clean Air Act 1968

Products of combustion emitted from chimneys serving furnaces burning conventional solid, liquid or gaseous fuels may contain:—

(*a*) *Solids*
Smoke, dust, ash, grit, fume.
(*b*) *Gases*
Carbon monoxide, carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen, hydrocarbons, oxygen and nitrogen; and a number of other minor constituents, including a host of trace elements.

By good combustion and the installation of efficient arrestors, the emission of solids, and to a lesser extent some of the gases, can be minimised, but removal of, for instance, sulphur dioxide is impracticable and the gases must therefore be discharged through a chimney of adequate height.

The basic thesis in the use of tall chimneys for waste gas dispersal is that there are no such things as dangerous gases or fumes, only dangerous concentrations.

The function of the chimney is to reduce the resulting ground level concentration of each constituent of the emission so that it is below the threshold which gives rise to a health hazard or a nuisance.

Under ideal conditions, and so far as gases are concerned, the ground level concentrations from a chimney discharge vary directly with the mass rate of emission and inversely with the wind speed and the square of the effective chimney height. Maximum ground level concentrations occur at about 10–15 times effective chimney heights distance.

Until the first edition of the Memorandum on Chimney Heights issued by the Ministry of Housing and Local Government in 1963, local authorities had a number of formulae which they could use for the calculation of a chimney height, particularly those recommended by the Beaver Committee in Appendix VI of its Final Report.

Revised in October 1967, the Memorandum on Chimney Heights still follows the basic principle in the amended edition that the pollution downwind from a chimney should not exceed a predetermined limit and that pollutants from the chimney must be considered in relation to pollution which exists from other sources.

Using either an average sulphur content for coal and oil of 1·6% and 3% respectively, or preferably using the known sulphur content, it is easy to calculate the mass emission of SO_2 (not forgetting that in the case of coal, 10% of the sulphur remains in the ash). In practice, because of the tremendous variation in sulphur content of coal it is usual to take the average of 1·6% for determining chimney heights, but to use the specification maximum for a particular class of oil when that fuel is to be used. It is also usual to base the fuel consumption on the maximum continuous rating of the boiler or other plant. Thus the chimney height is based on the maximum possible SO_2 emission from the plant and gives the industrialist some flexibility in the amount of fuel he might then burn without contravening the Act.

In the Memorandum, after the introduction of a description of the method, are printed a number of charts which allow firstly an uncorrected chimney height to be obtained based on SO_2 emission and the type of locality; and secondly a final height to be obtained by relating the uncorrected height to the height and/or length of the building in which the furnace is installed or the height of adjacent buildings.

An accurate assessment of the type of locality is important in determining the uncorrected chimney height, and the Memorandum gives the following guidance:—

(*a*) An undeveloped area where development is unlikely, where background pollution is low, and where there is no development within half a mile of the new chimney.
(*b*) A partially developed area with scattered houses, low background pollution, and no other comparable industrial emissions within a quarter of a mile of the new chimney.
(*c*) A built-up residential area with only moderate background pollution and without other comparable industrial emissions.
(*d*) An urban area of mixed industrial and residential development, with considerable background pollution and with other comparable industrial emissions within a quarter of a mile of the new chimney.
(*e*) A large city, or an urban area of mixed heavy industrial and dense residential development, with severe background pollution.

Category *c* represents average conditions, whilst categories *a*, *b*, *d* and *e* represent adjustments up or down, according to probable existing background pollution. Thus a chimney will be lower in Area *a* than in Area *c*, and highest in Area *e*.

It is emphasised that the Memorandum provides a relatively simple method of calculating the approximate chimney height commonly desirable in normal circumstances. There will sometimes, however, be occasions involving complex developments, or topographical complications, which are impossible to assess precisely by either experience or mathematics and it will then be necessary to have wind tunnel tests carried out on scale models.

Heights of Chimneys Serving Furnaces Not Burning Sulphur Bearing Fuels

The Memorandum can be utilised for determining stack heights only if the "fuel" contains sulphur in significant proportions, and there are no constituents of the chimney gases that are of more importance in relation to public health or nuisance than sulphur dioxide. Where there is no SO_2 emission, or where other constituents are of more importance, the height of the chimney cannot be assessed by use of the Memorandum on Chimney Heights. During 1970 the Warren Spring Working Group on Chimney Heights was reconstituted to produce a report recommending chimney heights for furnaces to burn natural gas, towns gas, liquid petroleum gas and low sulphur fuel oils. The working group is expected to produce its report during 1973.

B Clean Air Act 1956—Section 10

Although Section 10 of the 1956 Act no longer applies to a chimney serving a furnace, it will still apply to a chimney serving a non-combustion process, providing Building Regulation plans are required to be submitted for local authority approval. If the chimney is insufficient to prevent the emissions from becoming prejudicial to health or a nuisance, the local authority must reject the plans, and an aggrieved applicant may appeal to the Secretary of State for the Environment.

C. The Building Regulations 1972

The earlier notes show that the Clean Air Acts control chimney heights only if the fuel consumption is 100 lbs. or 1·25 million B.t.u. or more per hour.

The Building Regulations 1972 apply to *all* chimneys irrespective of the capacity of the fireplace or furnace, no matter what type of building the unit is installed.

Regulation L2(4)(*a*) requires that the flue outlet of a high rating appliance shall be so situated as to prevent the discharge therefrom into the external air from entering any opening into a building in such a concentration as to be prejudicial to health or a nuisance.

A "high rating appliance" is defined as
- (*a*) a solid fuel burning appliance or oil burning appliance with an output rating exceeding 45 kw.
- (*b*) a gas appliance having an input rating exceeding 45 kw.
- (*c*) an incinerator having a refuse combustion chamber exceeding $0{\cdot}03\text{m}^3$ in capacity.

In the case of Class I or Class II appliances the flue terminals must be correctly placed in accordance with Regulations 13 and 21 respectively.

A "Class I appliance" is defined as
- (*a*) a solid fuel appliance or oil burning appliance having an output rating not exceeding 45 kw.
- (*b*) an incinerator having a refuse combustion chamber capacity between $0{\cdot}03\text{m}^3$ to $0{\cdot}08\text{m}^3$.

A "Class II appliance" is defined as
- (*a*) a gas appliance having an input rating not exceeding 45 kw.
- (*b*) an incinerator having a refuse combustion chamber not exceeding $0{\cdot}03\text{m}^3$ in capacity.

D Public Health Act 1961

Section 28 of this Act applies when a new building is erected which will overreach the chimney of an adjoining building.

Providing that the chimney of the lower building is in the party wall between it and the taller building, or is 6 feet or less from the taller building, the local authority may by notice require the person who erects the taller building to raise the height of the chimneys of the adjoining building if it is reasonably practicable to do so, so that the chimneys are the same height as the taller building or its chimneys, whichever is the higher.

The notice will also require the owner or occupier of the adjoining building to allow the work to be done, but he may elect to do the work himself and charge the reasonable cost of so doing to the person on whom the notice was served.

In the event of non-compliance with the notice, the local authority may do the work in default.

Chimney Design

It is essential to emphasise that whilst the physical and effective heights of any chimney are of importance in ensuring the eventual dispersion of the waste gases etc., other features of the chimney (e.g. its shape, quality of thermal insulation, and cross sectional area at the outlet) must be carefully designed if stack inversion, acid condensate, smut emission, and downwash are to be avoided.

Summary of the Provisions Relating to Chimney Heights

The occupier of premises must seek approval of a chimney height when:—

1. (i) a new chimney is to be erected,
   (ii) an existing furnace installation is to be enlarged,
   (iii) a furnace is to be replaced by one of larger combustion capacity,
   but only if the new or enlarged plant is to burn pulverised fuel; other solid matter at 100 lbs. or more per hour; or liquid or gaseous matter at 1·25 million Btu or more per hour.
2. The local authority must give a written decision within 28 days, and may prescribe conditions.
3. The applicant can appeal to the Secretary of State for the Environment within 28 days of receiving the local authority decision, if aggrieved by the decision or conditions.
4. Chimney height approval is not required for certain exempted plant—mainly of temporary or experimental nature.
5. All chimneys must comply with the relevant provisions of the Building Regulations 1972 as to the position of the terminal.
6. In general the Ministry Memorandum on Chimney Heights is used, unless there are parameters more important than SO_2 emission which must be considered.
7. In some circumstances, the developer of a tall building may be required to raise the height of the chimneys of an adjoining building.

3. THE CONTROL OF GRIT, DUST AND FUME EMISSIONS

Although "grit" is defined in the Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 as "particles exceeding 76 microns in diameter", and "fume" is defined in the 1968 Act as "solid particulate matter smaller than dust", there is no definition of "dust".

It is, however, generally accepted that "dust is particulate matter smaller than 76 microns with a lower limit of one micron", and "fume" is sub-micronic in size.

Under the provisions of the 1956 Act the underlying principle in relation to stack solids was that any practicable means should be used for minimising grit and dust emissions. The various definitions recognised that technical problems would prevent the

complete elimination of emissions and that the measures required would vary according to circumstances. The requirement for grit arrestors to be installed in connection with new plant related only to those burning pulverised fuel, or other solid matter at the rate of one ton or more per hour.

The provisions of the 1968 Act take these first principles a stage further and also allow the various provisions to be related to fume emission as and when the Secretary of State feels the time to be appropriate.

The new provisions considerably strengthen and extend the local authority powers in relation to this problem, and since they are of fundamental importance they are set down under a series of sub-headings.

A Power of the Secretary of State to Prescribe Limits of Emission

Section two of the 1968 Act gives the Secretary of State power to prescribe limits on the rates of emission of grit and dust from the chimneys of furnaces, and to prescribe different limits for different cases and according to different circumstances.

(i) Working Party on Grit and Dust Emissions

During 1964 the then Minister of Housing and Local Government was considering the possibility of making Regulations to enable local authorities to require industrialists to measure grit and dust emissions. He decided that before doing so it would be advisable for local authority staff to receive guidance as to the available methods of measuring grit and dust, and the levels of emission, from various types of plant, which would be acceptable. Accordingly a Working Party on Grit and Dust Emissions was convened with the following terms of reference:—

> "To consider ways and means of measuring grit and dust emissions and to advise on the levels of emission admissible in relation to furnaces burning fuel equivalent to 100 lbs. to 50,000 lbs. of coal per hour."

The Report, published in 1967 proposed limits on the acceptable levels of emission from coal fired and oil fired boilers, and from furnaces where the stock being heated does not contribute to the emissions.

The working party considered that there was insufficient reliable data of emissions from furnaces where the stock contributed to emissions, or from incinerators, and recommended that there should be initiated a systematic study to obtain emission data from a representative sample of these classes of furnaces and, at the same time, to obtain some reliable information on the current technology of emission prevention. This study has recently been undertaken by N.I.F.E.S.

Those recommendations included in the Report were stated in lbs./hour of grit and dust emitted during a period of normal operation, including peak loads. In the case of coal fired plant the acceptable emissions ranged from 1% of the fuel, fired at a low rate of burning (100 lbs./hour) to 0·5% of the fuel fired at the top rate of burning (50,000 lbs./hour); and in the case of oil fired plant the acceptable emissions reduced from 0·4% of the fuel fired at a low rate of burning to 0·2% of the fuel fired at the top rate of burning. In the case of coal fired plant the working party recommended that the percentage grit in the sample from plant burning up to one ton per hour should not exceed 33%, and from plant burning over one ton per hour should not exceed 20%.

The Report of the Working Party was later endorsed by the then Ministry of Housing and Local Government in its publication "Grit and Dust—The Measurement of Emissions from Boiler and Furnace Chimneys—Standard Levels of Emission."

(ii) The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (Statutory Instrument 1971 No. 162)

The Regulations were made on the 1st February 1971, and came into operation on the 1st November 1971. They express in parliamentary and legal terminology the recommendations of the Working Party on Grit and Dust Emissions, but for a period until 1st January 1978 the Regulations will apply only to plant for which an agreement in respect of its purchase or installation was entered into after the date of operation i.e. there is a seven year exemption for existing installations.

The Regulations apply to:—

(*a*) boilers;
(*b*) indirect heating appliances (being heating appliances in which the combustion gases are not in contact with the material being heated);
(*c*) furnaces in which the combustion gases are in contact with the material being heated but that material does not in itself contribute to the grit and dust in the combustion gases.

The Regulations do not apply to incinerators burning refuse or waste matter (solid or liquid) whether or not the resulting heat is used for any purpose.

Schedules 1 and 2 of the Regulations tabulate the quantities of grit and dust which may be emitted, and where the rating of the boiler or furnace is intermediate between the tabulated values, the maximum permitted emission is obtained by interpolation:—

Schedule 1—Furnaces Rated by Heat Output

This schedule applies to boilers and also indirect heating appliances in which the material being heated is a gas or a liquid (e.g. an air heater) but where an indirect heating appliance falls also within the provisions of schedule 2, it shall be treated as schedule 1 furnace.

The amount of grit and dust which may be emitted is as follows:—

Max. Continuous Rating in lbs. of steam/hr. (from and at 100°C (212°F) *or in thousands of Btu/hr.*	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning solid matter	*Furnaces burning liquid matter*
,825	1·10	0·25
1,000	1·33	0·28
2,000	2·67	0·56
3,000	4·00	0·84
4,000	5·33	1·12
5,000	6·67	1·4
7,500	8·50	2·1
10,000	10·00	2·8
15,000	13·33	4·2
20,000	16·67	5·6
25,000	20·0	7·0
30,000	23·4	8·4
40,000	30	11·2
50,000	37	12·5
100,000	66	18
150,000	94	24
200,000	122	29
250,000	149	36
300,000	172	41
350,000	195	45
400,000	217	50
450,000	239	54·5
475,000	250	57

Schedule 2—Furnaces Rated by Heat Input

This schedule applies to indirect heating appliances and to furnaces in which the combustion gases are in contact with the material being heated, but that material does not in itself contribute to the grit and dust in the combustion gases.

The amount of grit and dust which may be emitted is as follows:—

Heat input in millions of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning Solid Matter	*Furnaces burning Liquid Matter*
1·25	1·1	0·28
2·5	2·1	0·55
5·0	4·3	1·1
7·5	6·8	1·7
10	7·6	2·2
15	9·7	3·3
20	11·9	4·4
25	14·1	5·5
30	16·3	6·6
35	18·4	7·7
40	20·6	8·8
45	22·8	9·8
50	25	10·9
100	45	16
200	90	26
300	132	35
400	175	44
500	218	54
575	250	57

The Regulations limit the grit in the sample of grit and dust to the following proportions:—

	Grit not to exceed 33%	*Grit not to exceed* 20%
Schedule One Furnaces	Where maximum continuous rating does not exceed 16,800 lbs./hr. of steam or 16,800,000 Btu/hr.	In any other case.
Schedule Two Furnaces	Where designed heat input of the furnace does not exceed 25,000,000 Btu/hr.	In any other case.

Grit is defined as those particles exceeding 76 microns in diameter (i.e. will remain on a BS.200 mesh sieve).

Multiflue chimneys are defined and for the purpose of the regulations each flue is to be taken as a separate chimney for the purpose of calculating acceptable emissions.

Where a chimney serves a furnace to which the regulations apply and also a furnace to which the regulations do not apply, the emissions from the latter shall be disregarded.

The prescribed limits apply to any period of standard operation of the furnace, including periods during which it is at or close to the loading to which it is subject for the greater part of its working time, or at any higher loading to which it is regularly subject for a limited time (whether or not this exceeds the furnace M.C.R. or designed heat input).

N.B. (1) Until the Regulations are made to apply to existing furnaces, or additional Regulations are made for furnaces where the material being heated contributes to the grit and dust emission, the occupier of the premises must use "any practicable means" for minimising the grit and dust emission.

(2) If the grit and dust emission from a chimney serving a furnace to which the Regulations apply, exceeds the permitted limit, there is a defence that the "best practicable means" had been used to prevent the emission.

The definition of "practicable" in the 1956 Act (it applies also to the 1968 Act) is of importance:—

> "Practicable" means reasonably practicable having regard, amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge, and "*practicable means*" *includes the provision and maintenance of plant and the proper use thereof.*

During 1972, the Secretary of State for the Environment appointed a new Working Party on Grit and Dust Emission with the following terms of reference:—

> "To advise on the levels of emission admissible under Section 2 of the Clean Air Act 1968 in relation to incinerators, and to furnaces where the material being heated contributes to the emission."

The Working Party has appointed three "panels" to study emissions from

(i) Incinerators
(ii) Cupolas
(iii) Miscellaneous Furnaces.

It is anticipated that the Working Party will report on the deliberations of one or more of the panels during 1973.

B Arrestment Plant for New Furnaces

Section 6 of the Clean Air Act 1956 required that certain larger new furnaces, the installation of which was commenced (or was subject to an agreement signed) between July 1956 and October 1969, should be equipped with approved grit and dust arrestment plant and that the arrestors must be properly maintained and used. These provisions still apply to furnaces which are used:—

(i) to burn pulverised fuel; or
(ii) to burn, at a rate of one ton an hour or more solid fuel in any other form or solid waste,

providing that the plant was installed or an agreement was signed between the above-mentioned dates.

Section 3 of the 1968 Act states that if new plant is to be installed after the 1st October 1969 (or is subject to an agreement signed after that date) and it is to be used

(*a*) to burn pulverised fuel; or
(*b*) to burn, at a rate of 100 pounds or more an hour, any other solid matter; or
(*c*) to burn, at a rate equivalent to 1¼ million or more British thermal units an hour, any liquid or gaseous matter,

it must, unless exemption has been provided, be equipped with grit and dust arrestment plant. In the event of a local authority refusing approval there is a right of appeal to the Secretary of State within 28 days of receiving the local authority's written decision.

Two types of exemption are possible by virtue of Section 4 of the 1968 Act:—

(i) The Secretary of State has power to provide in Regulations that furnaces of any particular class, whilst used for a prescribed purpose, should be exempted. He has now made the Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 1262) as follows:—

Class of Furnace	*Purpose*
1. Mobile or transportable furnaces.	(*a*) Providing a temporary source of heat or power during any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961); (*b*) providing a temporary source of heat or power for investigation or research; (*c*) providing heat or power for the purpose of agriculture (within the meaning of section 109(3) of the Agriculture Act 1947).
2. Furnaces, other than furnaces designed to burn solid matter at a rate of one ton an hour or more, which fall within any of the following descriptions and in which the matter being heated does not contribute to the emission of grit and dust:— (*a*) Furnaces burning liquid matter, gas, or liquid matter and gas; (*b*) hand-fired sectional furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*c*) magazine type gravity-fed furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*d*) furnaces fitted with an underfeed stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of the plan area of the combustion chamber; (*e*) furnaces fitted with a chain grate stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*f*) furnaces fitted with a coking stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of area covered by the fire bars excluding the solid coking plate.	Any purpose except the incineration of refuse

(ii) The local authority may, on application, exempt a specific furnace installation providing that they are satisfied that the emissions will not be prejudicial to health or a nuisance. The local authority must give a written decision within eight weeks, and an aggrieved applicant may appeal within a further 28 days, to the Secretary of State.

An offence occurs if a furnace is exempt and is then used for a purpose other than one prescribed in the exemption.

When considering an application for approval of a proposed arrestor plant (or an application for exemption from the need to install an arrestor plant) the local authority will have regard to the probable grit and dust burden in the flue gases, and to the known efficiency of the proposed arrestor plant in order that they might compare the probable emission with any standard which might at the time be in force or which is under consideration. Industrialists and consultants would, in turn, be wise to remember that the Working Party on Grit and Dust Emissions proposed that their recommended standard levels of emission should be reviewed after three years in operation and that arrestor plant, unless very well maintained at all times, rarely operates at design efficiency after a few years in use.

C The Measurement of Grit and Dust Emissions

The legal provisions concerning the measurement of grit and dust emissions are to be found in Section 7 of the 1956 Act as amended by Section 5 of the 1968 Act. Regulations have been made which prescribe the procedure to be followed by a local authority which wishes grit and dust measurement to be made and by the industrialist on whom a notice has been served.

If a furnace (or range of furnaces served by one chimney) is used to burn:—

(i) pulverised fuel, or
(ii) any other solid matter at a rate of 100 lbs. or more per hour, or
(iii) any liquid or gaseous matter, at a rate equivalent to $1\frac{1}{4}$ million or more Btu/hr.

the local authority may serve a notice on the owner of the plant or occupier of the building, requiring grit and dust emissions to be measured.

If the plant burns:—

(i) less than one ton/hour of solid matter other than pulverised fuel, or
(ii) less than 28 million Btu/hour of liquid or gaseous matter.

the industrialist may serve a "counter notice" on the local authority, requiring the authority to carry out the measurements at its own expense, and the local authority is obliged to do so "from time to time" unless the counter notice is, in writing, withdrawn.

The Clean Air (Measurement of Grit and Dust) Regulations 1971 (Statutory Instrument 1971 No. 161), prescribe the administrative process to invoke the above provisions (a similar set of Regulations apply to Scotland):

(*a*) A local authority must give at least six weeks' notice in writing to an industrialist requiring:—

  (i) adaptations to be made to the chimney or flues, and
  (ii) the provision of the necessary equipment,

to enable measurements to be made in accordance with BS.3405:1961 "Simplified Methods for Measurement of Grit and Dust Emission from Chimneys". The British Standard describes five different types of equipment which can be used, and it is necessary to ensure that the type and position of sampling points is correct in relation to the type of equipment which will be used. The British Standard is currently under review.

(*b*) When the sampling points have been installed and the equipment provided (or it is known that the firm are engaging a consultant who possesses the equipment), the local authority must give at least 28 days' notice in writing, requiring the tests to be carried out in accordance with the methods details in pp.13–26 of the B.C.U.R.A. publication "Measurements of Solids in Flue Gases".

(*c*) Before making the measurement, the industrialist must give the local authority at least 48 hours' notice in writing, of the date and time of the commencement of the tests.

(*d*) The 1968 Act requires the industrialist to permit the local authority to be represented during the tests.

(*e*) The result of the test must be sent to the local authority within 14 days from the making of the measurements, and the reports shall include:—

  (i) the date(s) of the test(s);
  (ii) the number of furnaces discharging into the chimney on that date;
  (iii) the results of the measurements expressed in lbs./hour of grit and dust emitted, and in the case of solid fuel fired plant, the percentage of grit in the solids.

A notice may require the making of measurements from time to time or at stated intervals, but not at intervals of less than 3 months unless in the opinion of the local authority, the true level of emission cannot be determined without further measurement being made.

If an industrialist serves a "counter-notice" on the local authority, he need comply only with the (*a*)(i) above, i.e. make adaptations to the chimney to enable the measurement to be made, including the provision of scaffolding where necessary, and the provision of facilities such as electrical connections to enable the sampling equipment to be used. The local authority must provide the sampling equipment and conduct the test entirely at its own expense.

In various circulars and publications, the Ministry of Housing and Local Government, and the Working Party have emphasised that the measurement of grit and dust emissions is both time consuming and costly. It is unlikely, therefore, that local authorities will authorise the indiscriminate service of hundreds of notices on industrialists, but will concentrate in the first instance on those units which are thought to be giving rise to complaint of nuisance, or which they suspect are emitting solids grossly in excess of the proposed limits. In any event the majority of local authorities have still to arrange for their staff to be trained in the use of the sampling equipment.

D **Fume Emission**

Fumes are defined in the 1968 Act as "any airborne solid matter smaller than dust", and by this definition acid mist or liquid droplets are thereby excluded.

By virtue of the 1968 amendment to the definition of chimney in the 1956 Act, this now "includes structures and openings of any kind from or through which smoke, grit, dust or fumes may be emitted, and in particular includes flues".

There are, at the moment, no legal provisions which require the reduction or elimination of fume emissions, other than those specific fumes which are controlled by the Alkali Inspectors under the provision of the Alkali &c. Works Regulation Act 1906, as amended and extended by the Clean Air Acts 1956 and 1968, and by the Alkali Works Order 1966.

An important provision in the 1968 Act for possible future consideration is the power in Section 7 of the Secretary of State to apply to "fumes", certain provisions of the 1956 and the 1968 Acts, i.e. by Regulations the Secretary of State may apply the following provisions to fumes, as they apply to grit, dust or smoke:—

(*a*) **Clean Air Act 1956—Section 3**
  Requirement that new furnaces shall be so far as practicable smokeless "*and fumeless*".

(*b*) **Clean Air Act 1968—Section 2**
  Emissions of grit, dust "*and fumes*" from furnaces (standard levels of emission).

Clean Air Act 1968—Section 3
  Requirements to fit arrestment plant (*including fume arrestors*) to new furnaces.

Additionally, the Secretary of State has power to extend certain exemption provisions so that they relate to fume emissions or avoid the need to install fume arrestment plant.

4. MISCELLANEOUS PROVISIONS OF THE CLEAN AIR ACTS 1956 AND 1968

A. The Clean Air Act 1956 Section 4—Smoke Density Meters

This Section enables the Secretary of State to make Regulations requiring the installation, maintenance and use of smoke density meters and/or recorders obligatory.

No regulations have yet been made and it is thought that this is because, although smoke density meters can be fairly reliable, they are easily subjected to abuse and the results obtained can be varied almost at will by altering the calibration or failing to clean the viewing glasses, etc., which protect the light source and receiver.

Section 8—Information About Furnaces and Fuel Consumed

The local authority is empowered, by this section, to require an industrialist to supply information within 14 days as to the size of furnaces and fuel consumption but this information, in the vast majority of cases is provided willingly and voluntarily.

Section 18—Colliery Spoilbanks (including Waste Quarry-Shale)

Where a spoilbank is emitting smoke and fumes, or is likely to emit smoke and fumes, the following provisions apply:—

(*a*) **A spoilbank in use as at 5th July 1956, or commenced since that date**

The owner of the mine or quarry is required to employ all practicable means for preventing spontaneous combustion and for preventing emission of smoke and fumes.

(*b*) **A spoilbank the use of which had ceased by 5th July 1956**

If the spoilbank was no longer in use and its control had passed from the owner of the mine or quarry on or before the 5th July, 1956, the problem must be dealt with as a statutory nuisance under the provisions of Part III of the Public Health Act 1936 as amended.

Section 19—Railway Engines

Railway engines are subject to the dark smoke provisions of Section one of the 1956 Act, but are not subject to grit and dust emission provisions, nor to a Smoke Control Order.

Section 20—Vessels

Emission of smoke from vessels has been considered on a previous page.

Section 21—Exemption for Purposes of Investigation and Research

This section gives the local authority power to exempt a particular chimney, boiler or furnace, etc., from varying provisions of the Act when it is expedient to do so, to enable investigations or research relevant to air pollution to be carried out without rendering the applicant liable to proceedings.

If the local authority refuse exemption, the applicant has a right of appeal to the Secretary of State for the Environment.

Section 22—Crown Premises

In the event of excessive emissions of smoke, grit and dust from Crown premises, the local authority should notify the Minister responsible for the premises and he shall take appropriate action to prevent or minimise the emission.

Section 23—Clean Air Council

By means of this section the Secretary of State has established the Clean Air Council with one of his Junior Ministers as Chairman to review progress and obtain advice on air pollution matters. There is also a Clean Air Council for Scotland (Statutory Instrument 1957 No. 766).

Sections 25-29

These sections are mainly administrative and relate to research and publicity, improper disclosure of information by an officer, penalties for offences under the Act (Some of which have been increased by the Criminal Justice Act 1967), authorisation of works, and enforcement of the Act.

B. The Clean Air Act 1968

The only important provisions of this Act not previously mentioned are contained in section 11 and relate to registered processes under the Alkali Act. The section substantially repeals section 17 of the 1956 Act, and in particular removes the power of the local authority to apply to the Secretary of State for authority to institute proceedings in the event of excessive smoke, grit, dust, etc., from registered processes. It also brings within the control of the Alkali Acts "work subject or potentially subject to the Alkali Act".

Building Regulations—Prevention of Smoke Emission

The Building Regulations 1972, include a section, M2, relating to the prevention of emission of smoke. The full text of the section is:—

> "M2. In any building (other than a building erected under former control) there shall not be installed for the purposes of heating or cooking in that or any other building any appliance which discharges the products of combustion into the atmosphere, unless that appliance is designed to burn as fuel either gas, coke, or anthracite. Provided that nothing in this regulation shall prohibit the installation of:—
>
> (i) a furnace which complies with Section 3 of the Clean Air Act 1956; or
>
> (ii) an appliance of a class exempted conditionally or unconditionally from the provisions of Section 11 of the Clean Air Act 1956 (which relates to smoke control areas) by any order for the time being in force under subsection (4) of that section; or
>
> (iii) a solid fuel appliance with a bottom grate unsuitable for burning coke or anthracite but designed so as to be capable of use with an alternative bottom grate which is suitable for burning such fuel.

5. ROAD TRAFFIC POLLUTION LAW

Despite the World wide opinion held over the last few years that emissions from motor vehicles exhausts must be controlled, very little useful legislation has been enacted in the U.K. to deal with this problem.

Statutory Instrument 1972 No. 805 entitled "The Motor Vehicles (Construction and Use) (Amendment) Regulations 1972".

Came into operation on the 27th June, 1972: Applies to diesel vehicles.

These Regulations are largely an amendment of similar Regulations of 1969, but some important additions have been made. The salient points are:

Clause 24 of the 1969 Regulations requires that every Motor vehicle be so constructed that no avoidable smoke or visible vapour is emitted. Clause 25 requires that excess fuel devices for easy starting be so fitted that they cannot be operated by a person whilst he is being carried by the vehicle, unless it cannot be used after the engine has started or does not cause any increase in smoke or visible vapour.

The new Regulations require most commercial vehicles to be equipped by their manufacturers with plates showing particulars of weights and other matters as from 1st April 1973 and a minimum power to weight ratio must be included.

The new Regulation 25B requires that on or after 1st April 1973 a compression-ignition engine shall be so constructed that it complies with the British Standards B.S.A.U. 141a for the maximum opacity of smoke emitted at all loads.

The Motor Vehicles (Construction and Use) (Amendment) (No. 5) Regulations 1972.

This regulation, which came into force on 7th December 1972, requires that petrol engines (spark ignition) vehicles (except small three-wheeled cars) first used on or after 10th November 1973 but not manufactured before 20th September 1973, shall comply with the limits for the emission of carbon monoxide and hydrocarbons laid down by ECE regulation No. 15, and that such vehicles should carry a designated approved mark.

It is claimed that this will reduce emissions of carbon monoxide by up to 30% and of hydrocarbons by up to 10%. This will be achieved by better carburation and spark timing devices.

The actual tests prescribed by ECE Regulation 15 requires that the car shall be tested on a chassis dynamometer by a cycle of conditions representing driving in a congested urban area after a cold start. The exhaust gases will be collected in a plastic bag for overall analysis. The maximum permissible mass of CO and HCs will be set out in a table relating them to the weight of the vehicle concerned.

A second test that will be carried out on new vehicles will be the measurement of the percentage of carbon monoxide at idling speed with a hot engine. The volume of CO content of the exhaust gases must not exceed 4.5%.

Since 1st January 1972 all new cars are required to be fitted with a device for re-cycling crankcase emissions.

The Secretary of State for the Environment has recently announced a phased programme to reduce the lead content of petrol. The maximum permitted level will be cut by almost one half over the next three years. The present permitted maximum is 0.84 grammes per litre. The intention is that the permitted maximum shall be reduced to 0.64 grammes per litre by the end of this year; to 0.55 grammes per litre by the end of 1973 and to 0.45 grammes per litre by the end of 1975.

6. THE ALKALI, ETC., WORKS REGULATION ACT

The Alkali, etc., Works Regulation Act, 1906, consolidates and extends previous similar Acts, the first of which was passed in 1863.

The Act includes a schedule of chemical processes and a list of noxious or offensive gases. Since 1906, this schedule and list have been extended by Statutory Orders made under the Public Health (Smoke Abatement) Act, 1926, and the Alkali, etc., Works Regulation (Scotland) Act, 1951. Such orders were made in 1928, 1935, 1939, 1950, 1958, 1961, 1963, 1966 and 1971.

The essence of the Act lies in the requirements that (1) scheduled processes must be registered annually; (2) as a prior condition in the case of a first registration the scheduled process must be provided to the satisfaction of the Chief Inspector with the "best practicable means" for preventing the escape of noxious or offensive gases to the atmosphere and for rendering such gases harmless and inoffensive; (3) the "best practicable means" must thereafter be maintained in good and efficient working order and must be operated continuously; (4) in the case of certain processes, upper limits are specified for the concentration of total acidity in effluent gases which may be discharged to the atmosphere.

Provision is made for the setting up and maintenance of an inspectorate to administer the Act, and regulations are included relating to the registration and inspection of works, general procedure, penalties, etc. The Chief Inspectors are required to make an Annual Report to be laid before Parliament, relating to the work of the inspectorate.

Under the Clean Air Act, 1956, later replaced by the Clean Air Act, 1968, the provisions of the Alkali Act are extended to apply to smoke, dust and grit from premises controlled under the Act as they already do to noxious or offensive gases. Thus from 31 December 1956 virtually all forms of air pollution from processes registered under the Alkali Act are subject to control under that Act by the Alkali Inspectorate. Any other parts of a work are the responsibility of the local authority.

The Alkali, etc., Works Orders

The first four Orders dealt mainly with processes in the heavy chemical and related industries where noxious or offensive gases are the potential offenders. In an Order which came into operation on 1 June 1958 the Minister of Housing and Local Government further extended the Alkali Act by adding to the list of scheduled processes a number which are responsible principally for emissions of smoke, grit and dust. Among these processes are a number for the production of iron and steel, iron or steel melting processes, and some copper and aluminium processes. Gas and coke works, electricity works, coal fired producer gas plant and lime kilns and certain ceramic kilns fired by coal or oil were also added to the list together with sulphate reduction and caustic soda plant and certain types of chemical incinerators. The Order also made the appropriate additions to the list of noxious or offensive gases.

The 1961 Order deals with emissions from the processing of uranium, beryllium, selenium and their compounds. The 1963 Order is much more comprehensive and was prepared largely to take into account the major changes which have taken place in recent years in the heavy chemical and allied industries. It also covers the burning of scrap cable to remove the insulation. This is necessary because of the increasing amount of cable covered with polyvinyl-chloride, which, on burning, gives rise to hydrochloric acid, chlorides and possibly phosgene. The Order begins the policy of descheduling certain of the 1958 Order smoke processes.

The 1966 Order is important, for in addition to making a few minor alterations to the lists of scheduled works and noxious or offensive gases, it revokes all the earlier seven Orders and consolidates them in the 1966 Order. The major effect of the 1971 Order was to schedule Mineral Works, dealing mainly with the crushing, grading and drying of roadstone giving rise to grit and dust problems. Some iron and steel and aluminium processes were descheduled. Thus, all the Alkali Acts and Orders since 1863 are consolidated in the 1906 Act and the 1966 and 1971 Orders.

LIST OF REGISTRABLE WORKS

Under the Alkali &c. Works Regulation Act 1906, as extended by the Alkali &c. Works Orders 1966 and 1971, the works appearing in the following list must be registered annually.

All certificates expire on 1st April, whatever the date of issue.

A certificate of registration becomes invalid if it is not kept up to date when changes occur in the ownership of the works or the other registered particulars. Any such change must be notified to the Ministry and the certificate forwarded for alteration. This will be done free of charge.

It is an offence, carrying a penalty of up to £100, to operate any of these works without a current and correct certificate of registration.

Non-scheduled Works

1. Alkali Works

Works for:

(*a*) The manufacture of sulphate of soda or sulphate of potash, or

(*b*) The treatment of copper ores by common salt or other chlorides whereby any sulphate is formed,
in which muriatic acid gas is evolved.

2. Cement Works

Works in which aluminous deposits are treated for the purpose of making cement.

3. Smelting Works

Works in which sulphide ores, including regulus, are calcined or smelted.

Scheduled Works

These are the works mentioned in the first Schedule to the Act, as extended by the Alkali &c. Works Order 1966, as follows:

1. Sulphuric Acid Works

Works in which the manufacture of sulphuric acid is carried on by the lead chamber process, namely, the process by which sulphurous acid is converted into sulphuric acid by the agency of oxides of nitrogen and by the use of a lead chamber or by any other process involving the use of oxides of nitrogen.

2. Sulphuric Acid [Class II] Works

Works in which the manufacture of sulphuric acid is carried on by any process other than the lead chamber process, and works for the concentration or distillation of sulphuric acid.

3. Chemical Manure Works

Works in which the manufacture of chemical manure is carried on, and works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid and works for the granulating of chemical manures involving the evolution of any noxious or offensive gas.

4. Gas Liquor Works

Works [not being sulphate of ammonia works or muriate of ammonia works] in which sulphuretted hydrogen or any other noxious or offensive gas is evolved by the use of ammoniacal liquor in any manufacturing process, and works in which any such liquor is desulphurized by the application of heat in any process connected with the purification of gas.

5. Nitric Acid Works

Works in which the manufacture of nitric acid is carried on and works in which nitric acid is recovered from oxides of nitrogen and works where in the manufacture of any product any acid-forming oxide of nitrogen is evolved.

6. Sulphate of Ammonia Works, and Muriate of Ammonia Works

Works in which the manufacture of sulphate of ammonia or of muriate of ammonia is carried on.

7. Chlorine Works

Works in which chlorine is made or used in any manufacturing process.

8. Muriatic Acid Works

(*a*) Muriatic acid works, or works [not being alkali works as defined in the Act] where muriatic acid gas is evolved either during the preparation of liquid muriatic acid or for use in any manufacturing process or as the result of the use of chlorides in a chemical process;

(*b*) Tinplate flux works, works in which any residue or flux from tinplate works is calcined for the utilization of such residue or flux, and in which muriatic acid gas is evolved; and

(*c*) Salt works, works [not being works in which salt is produced by refining rock salt, otherwise than by the dissolution of rock salt at the place of deposit] in which extraction of salt from brine is carried on, and in which muriatic acid gas is evolved.

9. Sulphide Works

Works in which sulphuretted hydrogen is evolved by the decomposition of metallic sulphides, or in which sulphuretted hydrogen is used in the production of such sulphides, or any works in which sulphuretted hydrogen is evolved as part of a chemical process.

10. Alkali Waste Works

Works in which alkali waste or the drainage therefrom is subjected to any chemical process for the recovery of sulphur or for the utilization of any constituent of such waste or drainage.

11. Venetian Red Works

Works for the manufacture of Venetian red, crocus or polishing powder, by heating sulphate or some other salt of iron.

12. Lead Deposit Works

Works in which the sulphate of lead deposit from sulphuric acid chambers is dried or smelted.

13. Arsenic Works

Works for the preparation of arsenious acid, or where nitric acid or a nitrate is used in the manufacture of arsenic acid or an arseniate and works in which any volatile compound of arsenic is evolved in any manufacturing process and works in which arsenic is made.

14. Nitrate and Chloride of Iron Works

Works in which nitric acid or a nitrate is used in the manufacture of nitrate or chloride of iron.

15. Bisulphide of Carbon Works

Works for the manufacture, use or recovery of bisulphide of carbon.

16. Sulphocyanide Works

Works in which the manufacture of any sulphocyanide is carried on by the reaction of bisulphide of carbon upon ammonia or any of its compounds.

17. Picric Acid Works

Works in which nitric acid or a nitrate is used in the manufacture of picric acid.

18. Paraffin Oil Works

Works in which crude shale oil is refined.

19. Bisulphite Works

Works in which sulphurous acid is used in the manufacture of acid sulphites of the alkalis or alkaline earths and works for the manufacture of liquid sulphur dioxide or of sulphurous acid or of any sulphite and works [not being smelting works as defined in section 8, sub-section [1] of the Act of 1906 or other works defined elsewhere in this schedule] in which oxides of sulphur are evolved in any chemical manufacturing process.

20. Tar Works

Works where gas tar or coal tar is distilled or is heated in any manufacturing process and works in which creosote or any other product of the distillation of gas tar or coal tar is distilled or is heated in any manufacturing operation involving the evolution of any noxious or offensive gas.

21. Zinc Works

Works in which by the application of heat, zinc is extracted from the ore, or from any residue containing that metal, and works in which compounds of zinc are made by dry processes giving rise to fume.

22. Benzene Works

Works [not being tar works as already defined] in which any wash oil used for the scrubbing of coal gas is distilled, or in which any crude benzol is distilled.

23. Pyridine Works

Works in which pyridine or picolines are recovered or made.

24. Bromine Works

Works in which bromine is made or is used in any manufacturing operation.

25. Hydrofluoric Acid Works

Works in which hydrofluoric acid is evolved in the manufacture of liquid hydrofluoric acid or its compounds.

26. Cement Production Works

Works in which argillaceous and calcareous materials are used in the production of cement clinker and works in which cement clinker is ground or cement is packed.

27. Lead Works

Works [not being works for the recovery of lead from scrap by direct liquation] in which, by the application of heat, lead is extracted from any material containing lead or its compounds, and works in which compounds of lead are manufactured from metallic lead or its compounds by dry processes which give rise to dust or fume.

28. Fluorine Works

Works in which fluorine or its compounds with other halogens are made or used in any manufacturing process, and works for the manufacture of fluorides, borofluorides or silicofluorides.

29. Acid Sludge Works

Works in which acid sludge produced in the refining of coal tar, petroleum or other hydrocarbon derivatives is treated in such manner as to cause the evolution of any noxious or offensive gas.

30. Iron Works and Steel Works

Works in which:

(*a*) iron or ferro-alloys are produced in a blast furnace and in which raw materials for use in blast furnaces are handled or prepared; or
(*b*) iron ores for use in blast furnaces are calcined or sintered; or
(*c*) iron or steel is melted in cupolas employing a heated air blast, or in electric arc furnaces; or
(*d*) steel is produced, melted or refined in Bessemer, Tropenas, open hearth or electric arc furnaces; or
(*e*) oxygen or air enriched with oxygen is used for the refining of iron or for the production, shaping or finishing of steels; or
(*f*) ferro-alloys are made by processes giving rise to fume.

31. Copper Works

Works in which:

(*a*) by the application of heat
  (i) copper is extracted from any ore or concentrate or from any material containing copper or its compounds; or
  (ii) molten copper is refined; or
  (iii) copper or copper alloy swarf is degreased; or
  (iv) copper alloys are recovered from scrap fabricated metal, swarf or residues by processes designed to reduce the zinc content; or
(*b*) copper or copper alloy is melted and cast in moulds the internal surfaces of which have been coated with grease-bound or oil-bound dressings. [But this paragraph does not apply to works in which the aggregate casting capacity does not exceed 10 tons per day.]

32. Aluminium Works

Works in which:

(*a*) aluminium swarf is degreased by the application of heat; or
(*b*) aluminium or aluminium alloys are recovered from aluminium or aluminium alloy scrap fabricated metal, swarf, skimmings, drosses or other residues by melting but not including works in which aluminium or aluminium alloys are separated from ferrous metals by liquation in sloping heater furnaces; or
(*c*) aluminium is recovered from slag; or
(*d*) molten aluminium or aluminium alloys are treated by any process involving the evolution of chlorine or its compounds; or
(*e*) aluminium is extracted from any material containing aluminium by a process evolving any noxious or offensive gases; or

(*f*) oxide of aluminium is extracted from any ore
and materials used in the above processes or the products thereof are treated or handled by methods which cause noxious or offensive gases to be evolved.

33. *Electricity Works*

Works in which:
(*a*) solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of public transport; or
(*b*) boilers having an aggregate maximum continuous rating of not less than 450,000 lbs. of steam per hour and normally fired by solid or liquid fuel are used to produce steam for the generation of electricity for purposes other than those mentioned in the preceding paragraph.

34. *Producer Gas Works*

Works in which producer gas is made from coal and in which raw producer gas is transmitted or used.

35. *Gas and Coke Works*

Works [not being producer gas works] in which:
(*a*) coal, oil or mixtures of coal or oil with other carbonaceous materials or products of petroleum refining or natural gas or methane from coalmines or gas derived from fermentation of carbonaceous materials are handled or prepared for carbonisation or gasification or reforming and in which these materials are subsequently carbonised or gasified or reformed; or
(*b*) Water gas is produced or purified; or
(*c*) coke or semi-coke is produced and quenched, cut, crushed or graded; or
(*d*) gases derived from any process mentioned in paragraph (*a*) are subjected to purification processes.

36. *Ceramic Works*

Works in which:
(*a*) pottery products [including domestic earthenware and china sanitary ware, electrical porcelain, glazed tiles and teapots] are made in intermittent kilns fired by coal or oil; or
(*b*) heavy clay or refractory goods are fired by coal or oil in
  (i) intermittent kilns; or
  (ii) continuous grate-fired kilns, not being tunnel kilns; or
  (iii) any kiln in which a reducing atmosphere is essential; or
(*c*) salt glazing of any earthenware or clay material is carried on.

37. *Lime Works*

Works in which calcium carbonate or calcium-magnesium carbonate is burnt through the agency of coal or oil.

38. *Sulphate Reduction Works*

Works in which metallic sulphates are reduced to the corresponding sulphides by heating with carbonaceous matter.

39. *Caustic Soda Works*

Works in which:
(*a*) either concentrated solutions of caustic soda or fused caustic soda are produced in vessels heated by coal; or
(*b*) black liquor produced in the manufacture of paper is calcined in the recovery of caustic soda.

40. *Chemical Incineration Works*

Works for the destruction by burning of wastes produced in the course of organic chemical reactions which occur during the manufacture of materials for the fabrication of plastics and fibres, and works for the destruction by burning of chemical wastes containing combined chlorine, fluorine, nitrogen, phosphorus or sulphur.

41. *Uranium Works*

Works [not being works licensed under the Nuclear Installations [Licensing and Insurance] Act, 1959, and not being nuclear reactors or works involving the processing of irradiated fuel therefrom for the purpose of removing fission products] in which:
(*a*) any ore or concentrate or any material containing uranium or its compounds is treated for the production of uranium or its alloys or its compounds; or
(*b*) any volatile compounds of uranium are manufactured or used; or
(*c*) uranium or its compounds are manufactured, fashioned or fabricated by any dry process giving rise to dust or fume.

42. *Beryllium Works*

Works in which:
(*a*) any ore or concentrate or any materal containing beryllium or its compounds is treated for the production of beryllium or its alloys or its compounds; or,
(*b*) any material containing beryllium or its alloys or its compounds is treated, processed or fabricated in any manner giving rise to dust or fume.

43. *Selenium Works*

Works in which:
(*a*) any ore or concentrate or any material containing selenium or its compounds is treated for the production of selenium or its alloys or its compounds; or
(*b*) any material containing selenium or its alloys or its compounds other than as colouring matter is treated, processed or fabricated in any manner giving rise to dust or fume.

44. *Phosphorus Works*

Works in which:
(*a*) phosphorus is made; or
(*b*) yellow phosphorus is used in any chemical or metallurgical process.

45. *Ammonia Works*

Works in which ammonia is:
(*a*) made; or
(*b*) used in the ammonia-soda process; or
(*c*) used in the manufacture of carbonate, nitrate or phosphate of ammonia or urea or nitriles.

46. *Hydrogen Cyanide Works*

Works in which hydrogen cyanide is made or is used in any chemical manufacturing process.

47. *Acetylene Works*

Works in which acetylene is made and used in any chemical manufacturing process.

48. *Amines Works*

Works in which:
(*a*) any methylamine or any ethylamine is made; or
(*b*) any methylamine or any ethylamine is used in any chemical process.

49. *Calcium Carbide Works*

Works in which calcium carbide is made.

50. *Aldehyde Works*

Works in which formaldehyde, acetaldehyde or acrolein or the methyl, ethyl or propyl derivate of acrolein are made.

51. Anhydride Works

Works in which acetic, maleic or phthalic anhydrides or the corresponding acids are made.

52. Chromium Works

Works in which any chrome ore or concentrate is treated for the production therefrom of chromium compounds or chromium metal is made by dry process giving rise to fume.

53. Magnesium Works

Works in which magnesium or any compound of magnesium is made by dry processes giving rise to fume.

54. Cadmium Works

Works in which metallic cadmium is recovered or cadmium alloys are made or any compound of cadmium is made by dry processes giving rise to fume.

55. Manganese Works

Works in which manganese or its alloys or any compound of manganese is made by dry processes giving rise to fume.

56. Metal Recovery Works

Works in which metal is recovered from scrap cable by burning the insulation.

57. Petroleum Works

Works in which:

(*a*) crude petroleum is handled or stored; or

(*b*) crude petroleum is refined by any operation carried out at petroleum refineries to convert crude petroleum into saleable products; or

(*c*) any product of such refining is subjected to further refining; or

(*d*) natural gas is refined; or

(*e*) any product of any of the foregoing operations is used, except as a solvent, in any subsequent chemical manufacturing process, not being a chemical manufacturing process described in any other scheduled work; or

(*f*) used lubricating oil is prepared for re-use by any thermal process.

58. Acrylates Works

Works in which acrylates are:

(*a*) made; or

(*b*) purified; or

(*c*) made or purified and polymerised.

59. Di-isocyanates Works

Works in which di-isocyanates are made, or partly polymerised or used in the manufacture of expanded plastics.

60. Mineral Works

Works in which metallurgical slags or pulverised fuel ash, or minerals are subjected to any size reduction, grading or heating by processes giving rise to dust, including the subsequent handling of the products of any such process but not including works for the processing of coal, lime works, ceramic works or foundries except in so far as the process carried on is described in any other scheduled work.

LIST OF NOXIOUS OR OFFENSIVE GASES

The requirement of the 1906 Act is that the best practicable means shall be used to prevent the escape of noxious or offensive gases, whether directly or indirectly, into the atmosphere and for rendering such gases where discharged harmless and inoffensive. The expression "noxious or offensive gas" includes; the list of gases and fumes given in section 27[1] of the Act as extended by the 1966 and 1971 Orders, and as effectively extended by Section 11[2] of the Clean Air Act, 1968, it also includes smoke, grit and dust. The list now includes:

Muriatic acid
Sulphuric acid and sulphuric anhydride
Sulphurous acid and sulphurous anhydride [except those arising solely from the combustion of coal]
Nitric acid and acid forming oxides of nitrogen
Chlorine and its acid compounds
Bromine and its acid compounds
Iodine and its acid compounds
Fluorine and its compounds
Arsenic and its compounds
Ammonia and its compounds
Cyanogen compounds
Pyridine
Bisulphide of carbon
Chloride of sulphur
Acetylene
Sulphuretted hydrogen
Volatile organic sulphur compounds
Fumes from benzene works
Fumes from cement works
Fumes from tar works
Fumes from paraffin oil works
Fumes from petroleum works
Fumes containing copper, lead, antimony, arsenic, zinc, aluminium, iron, silicon, calcium, or their compounds
Fumes containing chlorine or its compounds
Smoke, grit and dust
Fumes containing uranium, beryllium, cadmium, selenium, sodium, potassium or their compounds
Carbon monoxide
Acetic anhydride and acetic acid
Acrylates
Aldehydes
Amines
Di-isocyanates
Fumes containing chromium, magnesium, manganese, molybdenum, phosphorus, titanium, tungsten, vanadium or their compounds
Maleic anhydride, maleic acid and fumaric acid
Products containing hydrogen from the partial oxidation of hydrocarbons
Phthalic anhydride and phthalic acid
Picolines

THE BRITISH STANDARD RINGELMANN CHART AND THE BRITISH STANDARD MINIATURE SMOKE CHART

The method of visual assessment of smoke emission by comparison of the darkness of the smoke with the standard shades of grey on a chart placed in a suitable position was devised by Professor Ringelmann of Paris towards the end of the 19th century. Professor Ringelmann obtained the shades of grey by cross-hatching in black on a white background so that a known percentage of the white was obscured.

The British Standard Ringelmann Chart (B.S.2742C) see figure 1, is printed for the British Standard Institution so that the shades obtained in use are both consistent and near the average to those which users were accustomed when using the previously available commercially-printed Ringelmann Charts, including those issued by the U.S. Bureau of Mines.

The Chart consists of a cardboard sheet 581 mm ×

127 mm on which are printed five 101 mm (4″) squares, four of which are cross-hatched by 20 horizontal and 20 vertical lines so that in use the cross-hatched black lines merge into the white background and produce for each shade, apparently, a uniform grey. For an average observer, the Chart must be placed more than 15 metres distant to produce the uniform shade.

The numbers of the shades—the Ringelmann numbers—range from 0 to 5; each shade increasing by comparison with the previous number by 20% obscuration so that

Ringelmann 1 = 20% obscuration
Ringelmann 2 = 40% obscuration
Ringelmann 3 = 60% obscuration
Ringelmann 4 = 80% obscuration

Ringelmann 5 (100% obscuration) is not reproduced on BS.2742C, and the black strip is included only for control during printing.

"Dark smoke" is smoke which is as dark as or darker than shade 2 on the Chart.

"Black smoke" is smoke which is as dark as or darker than shade 4 on the Chart.

The Use of the Ringelmann Chart.

The use of the Ringelmann and Miniature Smoke Charts (see below) is described in BS.2742:1969.

The Ringelmann Chart should be firmly mounted onto a backing holder—aluminium is suitable—similar to that described in BS.2742. Protective coverings must *not* be applied to the Chart in use and nothing should impair the luminance of its working surface.

It should be used under daylight conditions and held in a vertical plane in line between the observer and the chimney top, at a distance of more than 15 metres to ensure the cross-hatched lines merge into shades of grey.

Where possible the general illumination of the sky should be uniform, but if the sun is shining or the sky bright on one side, the British Standard recommends that the bright source of illumination should be approximately at right angles to the line of vision and not in front of or behind the observer. Under hazy conditions observations should not be taken at extreme distance as there will be a tendency for the readings to be low. The angle of view of the Chart and smoke should be as low as possible; observations at a steep angle should be avoided.

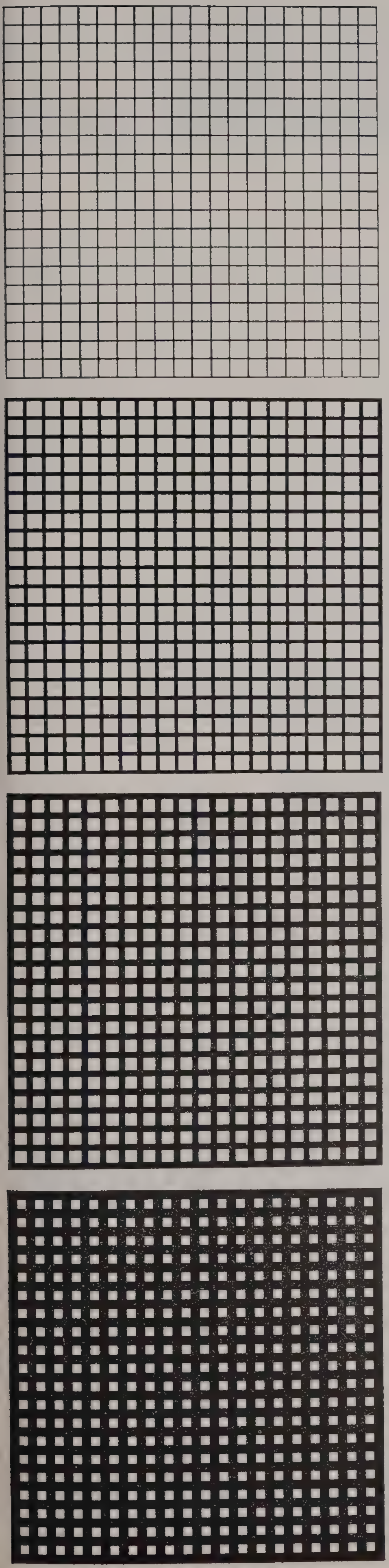
The darkness of the smoke at the chimney terminal should be compared with the Chart; the Ringelmann number which most closely matches the darkness of the smoke, and the time and duration of the emission should be noted. In favourable conditions it is possible to estimate smoke darkness to the nearest quarter Ringelmann.

The Miniature Smoke Chart (BS.2742M)

Because of the situations in which the British Standard Ringelmann Chart cannot be used, the British Standards Institution has developed the Miniature Smoke Chart.

The Miniature Smoke Chart is a small card 129 mm × 69 mm on which are printed shades of grey so that in use the shades correspond to the shades of the BS. Ringelmann Chart produced by the merging cross-hatching. The Standard indicates that, at this stage, the Miniature Smoke Chart is not intended for use as a substitute for the Ringelmann Chart; but in practice with an experienced observer the results obtained by use of either Chart are identical.

Since the Chart is slightly translucent, it should be



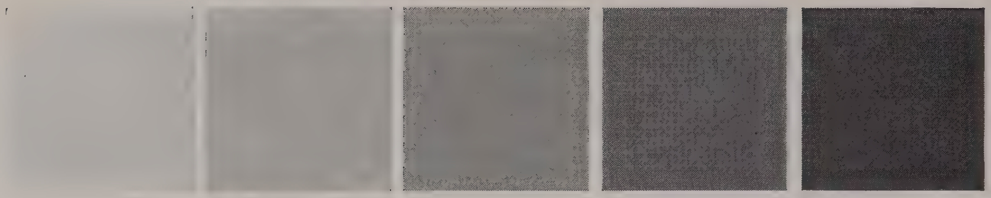
No. 1

No. 2

No. 3

No. 4

A photographic reproduction of the chart



A half-tone reproduction of the Miniature Smoke Chart

backed with white opaque material or placed in a holder.

The Standard recommends that the Chart should be held at a distance of 1.5 metres from the eye in a holder on the end of a light rod; but also indicates that it can be held at arm's length—with some reservation on the accuracy of the readings obtained.

In other respects—lighting, angle of view, etc.—the Miniature Smoke Chart should be used similarly to the British Standard Ringelmann Chart.

The Microringelmann Chart.

This is a card 127 mm × 84 mm on which are printed an accurate photographic reduction of the cross-hatched Ringelmann shades 1 to 4, above and below a horizontal slot through which the chimney top is viewed. The lines almost merge to a shade when, in use, the Chart is held at arm's length.

The recommended method of use is different from that of the British Standard Charts in that with the Microringelmann the sun should be behind the observer.

The Chart is printed with a reflective surface and great care is required to obtain an accurate assessment of smoke colour. Some experienced observers consider that the use of the Microringelmann Chart should not now be recommended because of this difficulty.

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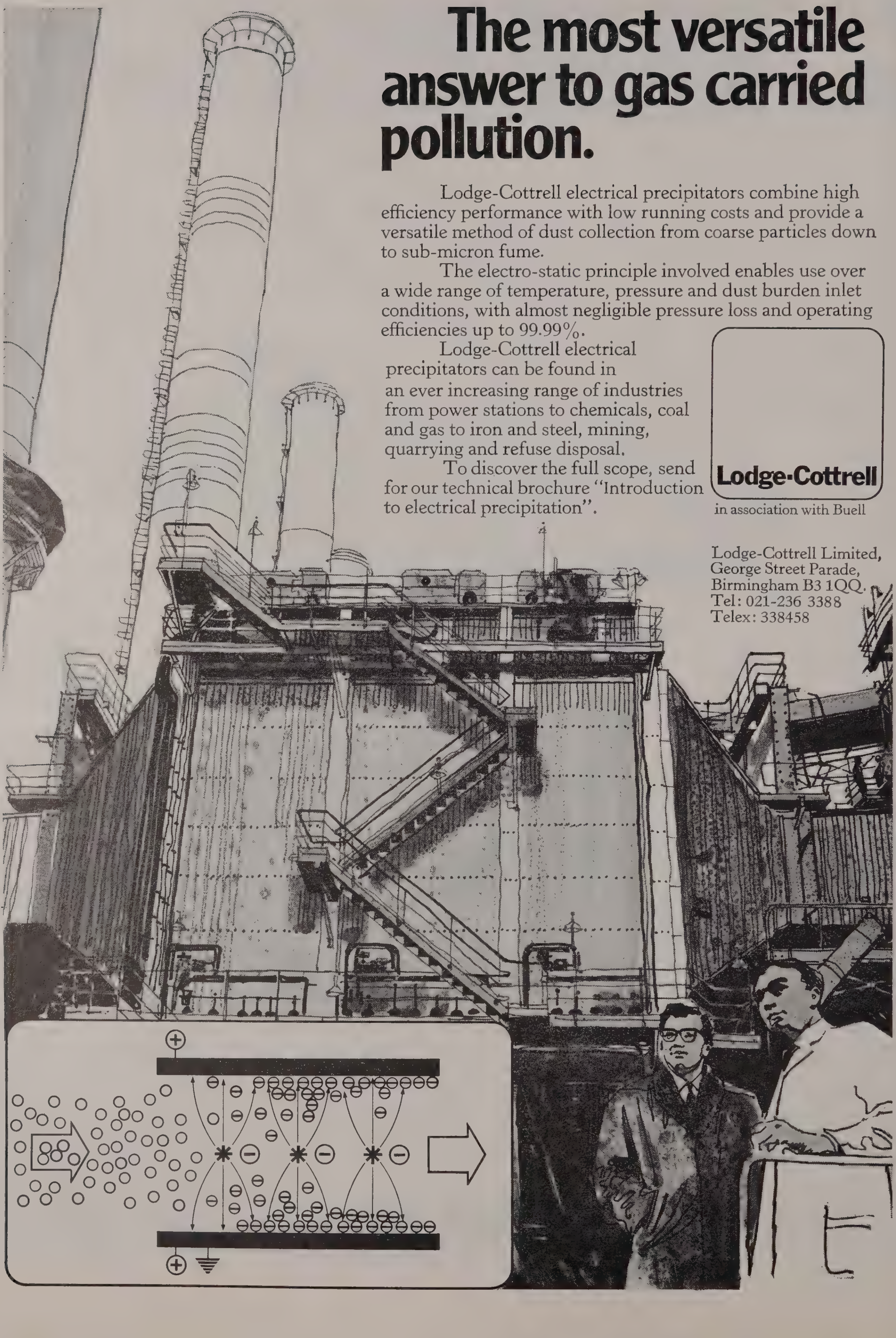

Section 3

Air Pollution Research Programmes in the United Kingdom

The following information is published by courtesy of the Interdepartmental Committee on Air Pollution Research, and is largely based on information supplied by the research organisations involved.

The table lists all research known to be in progress in 1971-2 and either partly or wholly funded by the government but it does not claim to be either exhaustive or fully up-to-date. It also includes some industrial organisations known to be concerned with air pollution research, but no attempt has been made to make it complete in this respect.

The programmes are arranged by subject in five parts, viz:

Part 1: Abatement of Emissions of Pollutants

Part 2: Dispersion and Distribution of Pollutants

Part 3: Effects on Health

Part 4: Effects on Animal Life, Vegetation and Materials

Part 5: Measurement Methods

(Addresses of organisations which occur several times are given at the end of the list).

Problem		*Investigation*	*Organisation*	*Officer Responsible*
Part 1. Abatement of Emissions of Pollutants				
1.1 Sulphur compounds	(a)	Removal from gases in fluid bed combustion systems	N.C.B., Coal Research Establishment	—
	(b)	Assessment of processes for removal of SO_2 from flue gases	C.E.G.B.	—
	(c)	Desulphurisation of combustion gases during combustion, using fluidised bed of lime particles	Esso	—
	(d)	Study of effectiveness of lime for treatment of acidic flue gases	Welwyn Hall Research Association, Church Street, Welwyn, Herts.	—
	(e)	Desulphurisation of residual feedstocks and fuel-oil blending components	B.P.	Manager
	(f)	Study of sulphur retention in fluidised bed combustion. (In collaboration with BCURA Ltd.)	B.P.	Manager
1.2 Grit and dust	(a)	Identification of grit and dust	W.S.L.	—
	(b)	Measurement of emission from chimneys	W.S.L. (for S.D.D.)	—
	(c)	Development of mechanised ash removal systems	N.C.B., Coal Research Establishment	—
	(d)	Grit, dust and fume in foundries and factors influencing concentrations and characteristics; sampling methods; exhaust systems; improvement of ventilation and fume in steelmaking	Steel Castings Research and Trade Association, East Bank Road, Sheffield S2 3PT	Dr. H. T. Hall (Director)
	(e)	Development of more efficient gas cleaning systems	British Steel Corporation, Corporate Laboratories	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(f) Measurement of emissions of pollution from steelworks plant; specification of equipment to reduce it; improving performance and efficiency of extraction systems	British Steel Corporation, Operating Divisions	—
	(g) Improvement in electrostatic precipitation	C.E.G.B.	—
	(h) Reduction of pollution due to ash disposal	C.E.G.B.	—
1.3 Air pollution from combustion	(a) Determination of emission levels of gas products from natural gaseous flames under various experimental conditions	Gas Council	—
	(b) Control of diesel combustion products and noise by use of intake additives	London University: University College, Dept. of Mechanical Engineering, Torrington Place, London W.C.1	Professor H. Billett
	(c) Reduction in emissions of nitrogen oxides from continuous combustion systems	Shell	—
	(d) Development of improved flare design	B.P.	Manager
	(e) Investigations into improvement of combustion in domestic and industrial oil-fired equipment with particular reference to solids, (NO_x), and unburnts	B.P.	Manager
	(e) Study of formation of nitric oxide in methane and other flames and of additives to reduce nitric oxide formation	Shell	—
	(f) Gas turbine emissions: effect of fuel composition, engine characteristics and operation	Shell	—
	(g) Study of growth of smoke particles, using model systems and shock tube techniques	Shell	—
	(h) Studies of emissions from stationary oil-fired sources ranging from space heaters and power station boilers to steel and chemical manufacturing plant	Esso	—
1.4 Particulates	(a) Research on fibrous filters and improvements of test methods	Ministry of Defence, Chemical Defence Establishment	—
1.5 Asbestos	(a) Development of fibre-reinforced inorganic materials not containing asbestos	Building Research Station, Garston, Watford, Herts.	J. B. Dick (Director)
1.6 Brickworks, etc.	(a) Reduction of smoke during firing of blue engineering bricks, roofing tiles and floor quarries, of fume during salting period in firing salt-glazed pipes, of acid soot and fumes especially from oil-fired kilns and/or when firing sulphur-bearing clays in the structural ceramic and refractories industry and of fluorine from pottery kilns	British Ceramic Research Association, Queens Road, Penkhull, Stoke-on-Trent ST4 7LQ	Dr. N. F. Astbury
	(b) Overcoming health hazard from dust in clay industries	British Ceramic Research Association, Queens Road, Penkhull, Stoke-on-Trent ST4 7LQ	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
1.7 Welding and flame cutting	(a) Study of toxic thermal degradation products	University of Newcastle-upon-Tyne, Dept. of Industrial Health, 21 Claremont Place, London NE2 4AA	Professor R. C. Browne
1.8 Coking plant	(a) Reduction of smoke emissions during oven charging; measurement, including development of methods; abatement of pollutants	British Coke Research Association, Chesterfield, Derbyshire	J. P. Graham
1.9 Industrial plant, especially copper and aluminium works	(a) Extended survey of sources of fuel emissions; data collection on composition and mass emission of fume; further pilot scale tests of collection equipment together with economic evaluations; advisory services	British Non-Ferrous Metals Research Association, Euston Street, London NW1 2EU	Dr. A. J. Kennedy
1.10 Motor vehicles	(a) Diesel		
	(i) measurement and reduction of smoke	London University: Queen Mary College, Dept. of Mechanical Engineering, Mile End Road, London E.1	Professor M. W. Thring
	(ii) measurement and reduction of smoke	W.S.L.	—
	(iii) measurement of smoke, and type testing of opacimeters; measurement of gaseous emissions	M.I.R.A.	—
	(b) (i) Exhaust emissions from petrol engines: effect of combustion chamber design; assessment of different measuring procedures; completion of assessment of exhaust gas recirculation	M.I.R.A.	—
	(ii) Removal of lead from exhaust gases by filtration	W.S.L.	—
	(iii) Removal of CO, NO_2, hydrocarbons from exhaust gases by catalytic devices	W.S.L.	—
	(iv) Petrol engine exhaust gases: reduction of pollution from, with emphasis on nitrogen oxides	Burmah-Castol Co.	—
	(v) Supply of oils to Ford and General Motors for testing effect of lubricating oils on emissions from cars fitted with catalytic exhaust systems	Burmah-Castrol Co.	—
	(vi) Co-operative studies (with U.K. motor industry) on emissions from cars; including use of dynamometer capable of operation at temperatures down to —30° F, and study of effects on motor fuel composition and vehicle performance of reduction of lead in motor fuels	B.P.	Manager
	(vii) Study of formation of nitric oxide in gasoline engines, and of additives for reduction of nitric oxide formation	Shell	—
	(viii) Injection of air into engine exhaust systems; shock tube studies on co-oxidation of CO and Hydrocarbons	Shell	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(ix) Study of emission of nitrogen oxides, CO and unburnt hydrocarbons from exhausts of petrol engines in relation to fuel and engine factors; fuel requirements of emission-controlled engines	Shell	—
	(x) Development of petrol-powered cars with acceptably low emissions by means of engine modifications, exhaust manifold reaction, and exhaust gas recycle. Study of effect of fuel quality on emissions	Esso	—
	(c) Isolation of aromatic hydrocarbons from petroleum	(i) Exeter University, Department of Chemistry (with M.R.C. grant)	—
		(ii) Manchester University, Institute of Science and Technology, Dept. of Chemical Engineering (M.R.C. grant)	—
	(d) Combination of steam-powered prime mover and hydrostatic transmission unit to exploit inherent low pollutant characteristics of external combustion unit	National Engineering Laboratory, East Kilbride, Glasgow	R. H. Weir (Director)
1.11 Aircraft (see also 5k)	(a) Production and consumption of pollutants from rich hydrocarbon/air flames, at high pressures, with particular reference to aircraft gas turbine conditions	National Gas Turbine Establishment, Pyestock, Farnborough, Hants.	I. M. Davidson
1.12 Domestic smoke	(a) Production of solid smokeless fuels: production scale work on carbonisation of small coal in a fluidised bed followed by briquetting of char without a binder, and on briquetting of high rank coal with pitch, followed by a mild heat treatment	N.C.B. Coal Research Establishment	—
	(b) Development of domestic appliances (room heaters and domestic central heating boilers) for burning small graded bituminous coal smokelessly	N.C.B. Coal Research Establishment	—
	(c) Measurement of smoke emission from solid fuel-fired appliances and from manufactured solid fuels	N.C.B. Coal Research Establishment	—
	(d) Measurement of smoke emission from oil-fired appliances and from fuel oils	B.P.	Manager
1.13 Odours	(a) Abatement of manure drying odours, etc.	W.S.L.	—
1.14 Hydrocarbon Emissions	(a) Measurement of hydrocarbon emissions from petroleum handling problems	B.P.	Manager
1.15 Pollution Control	(a) Analysis of causes and effects of existing and potential air pollution problems	B.P.	Manager
	(b) Assessment of flue gas desulphurization processes	B.P.	Manager

Problem	*Investigation*	*Organisation*	*Officer Responsible*
Part 2. Dispersion and Distribution of Pollutants			
2.1 Study of dispersion of chimney gases in order to minimise pollution by correct design and siting of chimneys	(a) High isolated chimneys: surveys round power stations	C.E.G.B.	—
	(b) High chimneys in built-up areas: wind tunnel and full scale studies	University of Bristol, Dept. of Aeronautical Engineering (under contract to C.E.G.B.)	T. V. Lawson
	(c) Chimney design in relation to nearby buildings: wind tunnel studies	University of Bristol, Dept. of Aeronautical Engineering (under contracts)	T. V. Lawson
	(d) Chimney design in relation to nearby buildings: comparison of wind tunnel and full scale tests	W.S.L.	—
	(e) Theoretical and experimental investigation, using wind tunnels, into turbulent flows near typical building shapes and effect of these flows on local dispersion of airborne pollution	University of Cambridge, Dept. of Applied Mathematics and Theoretical Physics, and Dept. of Engineering, Silver Street, Cambridge CB3 9EW	Dr. J. C. R. Hunt Dr. P. J. Mulhearn Dr. J. C. Mumford
	(f) Theoretical treatment of dispersion from stacks	B.P.	—
	(g) Measurement and advice on control of emissions from industrial chimneys	B.P.	Manager
	(h) Advice on the fundamentals of design of industrial chimneys	B.P.	Manager
	(j) Wind tunnel study of atmospheric diffusion of smoke plume from chimney stack	Brighton Polytechnic, Dept. of Applied Physics, Moulsecoomb, Brighton BN2 4GJ	P. Bradshaw
	(k) Emission and dispersion of smoke fumes from ships' funnels and industrial chimneys; wind tunnel tests	N.P.L., Division of Maritime Science	—
	(l) Wind tunnel studies for built-up areas	C.E.G.B.	—
	(m) Use of vortex rings to obtain very large rise for pollution, and allow use of low chimneys	British Hydromechanics Research Association, Cranfield, Bedford	G. F. W. Adler (Director of Research)
2.2 Case studies	(a) Studies include: (i) Supercooled fog on a proposed cooling lagoon at Connah's Quay (ii) SO_2 in the City of London and effects of architectural structure (iii) Dust on urban motorways (iv) Dispersion of odours from an urban source (v) Effects of details of local wind behaviour on dispersion of gases from Holyhead aluminium works, and meaningfulness of averages	London University: Imperial College of Science and Technology, Dept. of Mathematics, Exhibition Road, London SW7 (with S.R.C. support)	Professor R. S. Scorer
2.3 Studies of dispersion	(a) Dispersion of products of combustion	Gas Council	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Application of tracer gases to determination of ventilation patterns in areas ranging from rooms to towns	Esso	—
	(c) Dispersion of pollutants from European refinery complex	B.P. for CONCAWE	—
	(d) Measurement of SO_2 round Burmah refinery, Ellesmere Port, to determine effect on rural and urban G.L.C.	Burmah-Castrol Co.	—
2.4 Studies of dispersion and of the influence of meteorological factors	(a) Estimation of concentration of pollutants from specified source under wide range of weather conditions	Met. Office	—
	(b) Estimation of the concentration of a pollutant from specified source as a function of distance and weather conditions	Ministry of Defence, Chemical Defence Establishment	—
	(c) Long-range transport and dispersion of sulphur dioxide	W.S.L.	—
	(d) Surveys and analysis of the contributions of various classes of fuel usage to ground level pollution with reference to location and meteorological conditions	Esso	—
2.5 Studies of dispersion and of meteorological factors in the upper air over town and country	(a) Study of atmospheric turbulence and convection in first few thousand feet above ground, using instruments on towers or on tethered balloons; study of vertical temperature, wind and humidity up to 4,000 ft. using radiosondes, free or on tethered balloons	Met. Office	—
2.6 Studies of dispersion on global scale	(a) Monitoring of radioactive debris from nuclear explosions	A.E.R.E.	—
	(b) Application of radioactive techniques to, e.g. diffusion in stratosphere	A.E.R.E.	—
	(c) Development of models of worldwide atmospheric circulation and climate with possible future applications to studies of the dispersal of pollutants	Met. Office	—
	(d) Measurement of SO_2 over the North Sea (Further studies are being considered in conjunction with Government bodies)	B.P.	Manager
2.7 Trends in global pollution	(a) Investigation of dated Antarctic ice cores to give historical evidence of air-borne substances	British Antarctic Survey, Scott Polar Institute (supported by N.E.R.C. and D.E.S.), 30 Gillingham Street, London SW1	Sir Vivian Fuchs
2.8 Distribution of pollutants throughout the United Kingdom, especially in relation to application of the Clean Air Act	(a) The National Survey of Smoke and Sulphur Dioxide	W.S.L. in co-operation with Local Authorities, the C.E.G.B. and other organisations	—
2.9 Distribution of pollutants throughout the United Kingdom	(a) Metals: (i) survey of relative burdens of atmospherically borne metals in Britain	University of Wales, Swansea, Dept. of Botany	G. Goodman
	(ii) environmental analysis: trace metals in air	A.E.R.E.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
2.10 Distribution of pollution in urban areas in relation to meteorological and geographical factors and to the needs of medical investigators, town planners, etc.	(a) Using National Survey and meteorological data, reformulation of operational forecasting scheme for high concentrations of SO$_2$ in London, and investigation of applicability of scheme to other cities	Met. Office	—
	(b) Sheffield: Analysis of pollution trends in relation to smoke control and changing fuel usages; effect of introduction of North Sea gas; incidence of pulses of high SO$_2$; effect of met. conditions on pollution and vice versa; weather and diurnal smoke, SO$_2$ patterns; SO$_2$ and health	Sheffield University, Dept. of Geography, Air Pollution Unit, and the Gas Council	Professor Alice Garnett
	(c) London: with particular reference to temperature and air flow and application of trend surface analysis	London University: University College, Dept. of Geography, Gower Street, London W.C.1	Professor T. J. Chandler
	(d) Brighton: with particular reference to temperature	London University: University College, Dept. of Geography, Gower Street, London W.C.1	—
	(e) Modelling of pollution	W.S.L.	
	(f) Pollution by traffic: (i) improvement of predictive equations for CO (and for other environmental factors) in urban streets	London University: Imperial College of Science and Technology, Dept. of Civil Engineering, Imperial Institute Road, London S.W.7	D. H. Crompton
	(ii) monitoring of malodorous traffic pollutants	London University: Imperial College of Science and Technology, Dept. of Civil Engineering, Imperial Institute Road, London S.W.7	—
	(iii) survey in five towns	W.S.L.	—
	(g) Special surveys at chosen locations to identify and determine gaseous pollutants	Ministry of Defence, Chemical Defence Establishment	—
	(h) Studies of the sensitivity and applicability of lidar to the detection of aerosols in the atmosphere	Ministry of Defence, Chemical Defence Establishment	—
	(j) Measurement of SO$_2$ and particulates in 4 European cities to determine relative contributions of industrial and space heating sources to urban air quality. Data analysis in terms of fuel patterns, population distribution and meteorology	Esso	—
	(k) Correlation of SO$_2$ concentrations in British towns and cities with fuel consumption	B.P. for Institute of Petroleum	—
2.11 Distribution of pollution in rural areas	(a) Continuous monitoring (at Porton) of rural atmosphere for presence of organophosphorus pesticides	Ministry of Defence, Chemical Defence Establishment	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Monitoring of trace elements in rainwater at six sites	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service	Regional Officers
2.12 Pollutants in remote areas	(a) Sulphur, chlorine, sodium, potassium, calcium, magnesium, ammonia, in air and in rain; NO_3 and H_2CO_3 in rain; measurements at three sites	Met. Office (analysis by the Government Chemist)	—
	(b) Distribution of air pollution in the New Forest with particular reference to lichen distribution	Portsmouth College of Technology, Dept. of Biological Sciences, Park Road, Portsmouth, Hants.	F. N. Haynes
	(c) Sulphur dioxide and smoke in air	W.S.L.	—
2.13 Pollution from aircraft	(a) Surveys of pollution at ground level at and near airports	W.S.L.	—
2.14 Distribution of pollutants from specific sources	(a) Lead	W.S.L.	—
	(b) Fluorine: at Invergordon	W.S.L. (for S.D.D.)	—
2.15 Pollution from motorways (see also 2.2(iii))	(a) Dust fall in the vicinity of motorways	University of Reading, Dept. of Geography, Whiteknights, Reading RG6 2AF	M. Parry
2.16 Air pollution in relation to climate, etc.	(a) Measurement of radiative properties of cloud, fog and haze	N.E.R.C. and Oxford University, Dept of Atmospheric Physics	Dr. J. T. Houghton
	(b) Effect of air pollution on income of short wave radiation at the surface, and on radiation balance	University of Nottingham, School of Agriculture, Dept. of Physiology and Environmental Studies, Sutton Bonington, Loughborough	Professor J. L. Monteith
	(c) Evaporation from a catchment in relation to air pollution	University of Nottingham, School of Agriculture, Dept. of Physiology and Environmental Studies, Sutton Bonington, Loughborough (sponsored by N.E.R.C.)	Professor J. L. Monteith
	(d) Concentrations of smoke and SO_2 in rural areas of England and Wales in relation to climatological and geographical factors	London University: University College, Dept. of Geography	Professor T. J. Chandler
	(e) Aerobiology in relation to forest disease development	Oxford University, Forestry Dept.	R. G. Pawsey Dr. T. W. Tinsley
	(f) Relationship between visibility, relative humidity, droplet population and particulate pollutants	A.E.R.E.	—
	(g) (i) investigation of the geographical distribution of mist on Teeside and the correlation between visibility, chemical composition of the atmospheric aerosol and other meteorological factors; (ii) measurement of ammonia and SO_2 levels on Teesside to study the kinetics of their conversion to ammonium sulphate, a major contribution to the mist; identification of the meteorological and other factors which assist the conversion;	A.E.R.E.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(iii) comparison measurements of ammonia, SO_2, ammonium sulphate and other particulates at other sites in the country; (iv) laboratory investigations of the kinetics of both the homogeneous and heterogeneous formation of ammonium sulphate from ammonia and SO_2		
	(h) Relationship between pollution and rainfall	London University: University College, Dept. of Geography	Professor T. J. Chandler
2.17 Life-history of pollutants in the atmosphere	(a) Laboratory and field studies of SO_2 oxidation by catalytic mechanisms and photochemical reactions in the presence of hydrocarbons and oxides of nitrogen	A.E.R.E.	—
	(b) Condensed particles derived from gaseous pollutants; mists: (i) kinetics of aerosol formation from SO_2 and NH_3 and from other gases; (ii) kinetics of growth of H_2SO_4 droplets in conditions analogous to (a) the respiratory system, and (b) mists occurring in manufacture of the acid	London University: Imperial College, Dept. of Chemical Engineering and Chemical Technology, Prince Consort Road, London S.W.7	Dr. M. J. G. Wilson
	(c) Dispersion of major pollutants: fate of SO_2 in atmosphere: chemical changes, mechanisms of removal and their interaction with dispersion on all scales	London University: Imperial College of Science and Technology, Dept. of Mathematics (with support of Shell)	Professor R. S. Scorer
	(d) Chemistry and fate in atmosphere of SO_2, NO etc.	C.E.G.B.	—
	(e) Study of haze which reduces visibility and sunlight on dry days in rural areas	Shell	—
2.18 Bactericidal properties of pollutants	(a) Studies of bactericidal properties of pollutants in urban areas with reference to recognition of the presence of olefin-ozone reaction products	Ministry of Defence, Microbiological Research Establishment	—
2.19 Studies in air pollution	No details available	Gas Council	—
2.20 Sulphur and the land	(a) Assessment of sulphur reaching the land in Britain	C.E.G.B.	—
2.21	(a) Atmospheric submicron aerosol as related to measurement of air quality	University of Cambridge, Dept. of Physics (N.E.R.C. grant)	—
2.22	(a) Halomethane in atmosphere	University of Reading (N.E.R.C. grant)	—
Part 3. **Effects on Health** Medical research to indict as far as possible specific pollutants responsible for ill effects on health and to suggest maximum levels of tolerance			
3.1 Specific pollutants	(a) The recognition of industrial and other pollution and pathogenic particles	University College of South Wales and Monmouthsire, Dept. of Mineral Exploitation	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Inhalation of aerosols by man:	University of Essex, Dept. of Chemistry (M.R.C. External Scientific Staff)	—
		University of Essex, Dept. of Chemistry (M.R.C. grant)	
	(c) Study of effects of emissions from motor vehicles	M.R.C., Air Pollution Unit	—
	(d) Physiological effects of chronic exposure to carbon monoxide	Surrey University, Dept. of Biological Sciences (M.R.C. grant)	—
	(e) Immunochemical analyses of fungal and other glycopeptides	Institute of Diseases of the Chest, Dept. of Clinical Immunology (M.R.C. grant)	—
	(f) Tobacco smoke: relationship between sugar content of tobacco and pH of smoke, for cigarettes, cigar and pipe tobaccos and relationship to toxicity and lung cancer risks of smoking	London University: Institute of Cancer Research, Biophysics Dept., Chester Beatty Institute, Fulham Road, London S.W.3	The Director
	(g) Antimony: effect of antimony dust on the lungs	University of Newcastle-upon-Tyne, Dept. of Industrial Health	Professor R. C. Browne
	(h) Asbestos:		
	(i) effects	M.R.C., Pneumoconiosis Unit	—
	(ii) asbestos-related disease in a ship building community; incidence and complications in Barrow-in-Furness	Barrow-in-Furness Hospital (M.R.C. grant)	—
	(iii) mortality studies of male and female asbestos factory workers	London School of Hygiene & Tropical Medicine, Keppel Street, London W.C.1 (M.R.C. grant)	Professor D. D. Reid
	(iv) immunological changes associated with pleural plaque formation and mesothelioma in a community potentially exposed to asbestos	Barrow-in-Furness North Lonsdale Hospital, Pathology Laboratory	—
	(v) pleural changes occurring in a population potentially exposed to asbestos	Barrow-in-Furness North Lonsdale Hospital, Pathology Laboratory (M.R.C. grant)	—
	(vi) modification of the effects of asbestos and related dusts in tissues	Reading University (M.R.C. grant)	—
	(vii) study of solubility of asbestos *in vivo* and the use of induced radioactivity to investigate the fate of inhaled and ingested asbestos fibres	A.E.R.E.	—
	(viii) follow-up of boiler and steam pipe insulaters exposed to asbestos in the past	University of Newcastle-upon-Tyne, Dept. of Industrial Health	Professor R. C. Browne
	(ix) concurrent study of changes in pathology in respiratory function in guinea pigs exposed to asbestos dust	University of Manchester, Dept. of Occupational Health, Clinical Sciences Building, York Place, Manchester M13 0JJ	Professor W. R. Lee
	(j) Benzene: effect of benzene in atmosphere on health	B.P., in co-operation with other companies for Institute of Petroleum	—

Problem	Investigation	Organisation	Officer Responsible
	(k) Chemistry and biochemistry of interaction of benzpyrene and related carcinogens with D.N.A., R.N.A. and their components	Sheffield University, Dept. of Chemistry	—
3.2 Occupational health	(a) Physiological effects of industrial dusts	M.R.C., Pneumoconiosis Unit	—
	(b) Pneumoconiosis of coal workers: application of radiography, lung function and morbid anatomy to study the different subgroups of the condition	M.R.C., Pneumoconiosis Unit	—
	(c) Cotton and other vegetable dusts, including farmers' lung	M.R.C., Pneumoconiosis Unit	—
	(d) Byssionosis: determination of particle size distribution and analysis of different size fractions of cotton card-room dust	University of Manchester, Dept. of Occupational Health, Clinical Sciences Building, York Place, Manchester M13 0JJ	Professor W. R. Lee
	(e) Pharmacological properties of cotton and other vegetable fibre dusts in relation to the acute symptoms of byssinosis	Cardiff Institute of Science and Technology (M.R.C. grant)	—
	(f) Influence of duration and intensity of exposure on the elimination of high and low rank coal dusts	University of Newcastle-upon-Tyne, Dept. of Pathology (M.R.C. grant)	—
	(g) Relation of composition of welding rods to fumes produced in welding	University of Newcastle-upon-Tyne, Dept. of Industrial Health	Professor R. C. Browne
	(h) Absorption of inhaled chlorinated and fluorinated hydrocarbon vapours and their subsequent excretion in breath using ^{38}C1 tracer techniques	A.E.R.E.	—
	(j) Monitoring of potentially hazardous and uncomfortable environments within working locations	B.P.	Manager
3.3 Studies of lung function, etc.	(a) Theoretical study of lungs and pneumatic system	M.R.C., Air Pollution Unit	—
	(b) Investigation of effects of pollutants in pulmonary function	M.R.C., Air Pollution Unit	—
	(c) Analysis of respiratory wave forms using on-line computer techniques	M.R.C., Air Pollution Unit	—
	(d) The effects of air pollutants on the growth and morphology of respiratory pathogens	M.R.C., Air Pollution Unit	—
	(e) Preclinical stages of chronic bronchitis (smoking habits and effects of air pollution)	London Royal Postgraduate Medical School (M.R.C. grant)	—
	(f) Factors affecting the deposition and clearance of particulate material from the human nose using radioactive tracer techniques	A.E.R.E.	—
	(g) Correlation between lung disease and respirable dust	Safety in Mines Research Establishment, Red Hill, Broad Lane, Sheffield	Dr. C. A. A. Wass

Problem	*Investigation*	*Organisation*	*Officer Responsible*
3.4 Epidemiology	(a) Variations in mortality, in the demands for hospital admission and in the clinical condition of patients with chronic bronchitis and emphysema in relation to daily changes in weather and air pollution	M.R.C., Air Pollution Unit	—
	(b) Daily variation in the respiratory function of normal subjects	M.R.C., Air Pollution Unit	—
	(c) Surveys of respiratory symptoms and ventilatory capacity in relation to smoking and air pollution	M.R.C., Air Pollution Unit	—
	(d) Analysis of data on lung cancer mortality in relation to urban factors	M.R.C., Air Pollution Unit	—
	(e) Studies of effects of air pollution	Dept. of Health and Social Security, Alexander Fleming House, Elephant and Castle, London S.E.1	Dr. A. E. Martin
	(f) Respiratory disease and function in young families in Harrow, and in school-children in Kent	London University: St. Thomas's Hospital Medical School, Dept. of Clinical Epidemiology and Social Medicine, London S.E.1	Professor W. W. Holland
	(g) Chronic respiratory diseases in relation to pollution and smoking in the U.K.: international studies in Britain, U.S. and Norway with particular reference to migrants from Britain; upper and lower respiratory tract disorders in town and country children	London University: London School of Hygiene and Tropical Medicine, Dept. of Medical Statistics and Epidemiology, Keppell Street, London W.C.1	Professor D. D. Reid
	(h) Effects of dust, containing spores from mouldy hay/grain, on the lungs of farmers in Scotland	University of Dundee, Dept. of Social and Occupational Medicine	Professor A. Mair
Part 4. Effects on Animal Life, Vegetation and Materials			
4.1 Animal Life	(a) Fluorosis in farm animals	Ministry of Agriculture, Fisheries and Food, Central Veterinary Laboratory, New Haw, Weybridge, Surrey	Dr. A. B. Paterson
	(b) Agricultural significance of airborne pollution by lead and other elements from industrial sources (several centres)	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service	—
	(c) Industrial melanism in the Manchester area	University of Manchester, Dept. of Zoology (N.E.R.C. grant)	—
	(d) Adverse effect of airborne heavy metals and other metallic ions upon metabolism of essential trace elements in animals	Rowett Research Institute, Bucksburn, Aberdeen	Dr. K. L. Blaxter
4.2 Vegetation (see also 4.1(b))	(a) Lichens and bryophytes: (i) Use of lichens as indicators of distribution of air pollution; distribution of latter in relation to topography	London University: King's College, Dept. of Geography, Strand, London W.C.2	Dr. F. Rose

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(ii) effect of sulphite and sulphate on lichens, with reference to air pollution	University of Newcastle-upon-Tyne, Dept. of Botany	D. J. Hill
	(iii) effect of air-borne fluorides on lichens, bryophytes and higher plants	Sheffield University, Dept. of Landscape Architecture	Dr. O. L. Gilbert
	(iv) ecological effects of air pollution on epiphytes and the phenomenon of industrial melanism in insects	University College, Cardiff, Dept. of Zoology	Dr. E. R. Creed
	(v) effect of air pollution on the establishment of bryophyte spores on tree barks	London University: Queen Mary College, Dept. of Plant Biology and Microbiology, Mile End Road, London E.1	Dr. P. J. Wanstall
	(vi) Distribution of lichens in vicinity of aluminium smelter, Anglesey	Nature Conservancy, Bangor	—
	(b) Uptake of SO_2 by vegetation	A.E.R.E.	
	(c) Effect of SO_2 on yields of rye grass	A.E.R.E. and London University: Imperial College of Science and Technology	—
	(d) Contamination of plants and soils by lead and other trace elements as a result of atmospheric pollution	Macaulay Institute for Soil Research, Cragiebuckler, Aberdeen	Dr. R. L. Mitchen
	(e) Effects of (i) smoke in suspension, (ii) SO_2 in atmosphere; husbandry practices to alleviate effects; field studies	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Great House Experimental Husbandry Farm, Helmshore, Passerdale, Lancs.	C. H. Mudd
	(f) Effects of nearby major source of air pollution on deciduous woodland	University of Wales: Cardiff Institute of Science Technology, Dept. of Applied Biology, Cathays Park, Cardiff, Wales (sponsored by N.E.R.C.)	Professor R. W. Edwards
	(g) Growth of trees in the Pennines in relation to air pollution	Forestry Commission, Research Division, Alice Holt Lodge, Wrecclesham, Farnham, Surrey	Dr. D. H. Phillips
	(h) Effects of pollution from an aluminium smelter on the surrounding forest area	Forestry Commission	—
	(j) Effects of sulphur dioxide and heavy metals on angiosperms	Plymouth Polytechnic, Dept. of Environmental Sciences	Dr. F. B. Pyatt
	(k) Effects of air pollution on plant growth in glasshouses	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Lee Valley Experimental Horticulture Station, Ware Road, Hoddesdon, Herts.	P. G. Allen
	(l) Methods of cleaning glass	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Lee Valley Experimental Horticulture Station, Ware Road, Hoddesdon, Herts.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(m) General evaluation of the field and formulation of general pollutant/damage functions	Manchester University, Pollution Research Unit, Mathematics Building, Oxford Road, Manchester M13 9PL	Dr. N. Lee
	(n) Responses of lower plants to pollutants from internal combustion engines; effects on metabolic sites, photosynthesis	Aberdeen University, Dept. of Botany	—
	(o) Effects of gaseous atmospheric pollution on plants	Sheffield University, Dept. of Botany	—
4.3 Materials	(a) Effect of air pollution as a factor in the durability of building materials (stone, concrete, surface coatings, plastics, metals, fired cl fired clay products)		
	(i) dirt adhesion and removal on silicate-based materials	University of Cambridge, Dept. of Surface Physics, Cavendish Laboratory, Free School Lane, Cambridge (under contract from D.O.E., Building Research Station)	Professor Tabor
	(ii) dirt pick-up on paint	Paint Research Station (under contract from D.O.E., Building Research Station)	—
	(iii) synergistic effect of SO_2 in degrading of plastics	University of Aston, Aston Polymer Research School (under contract from D.O.E., Building Research Station)	—
	(iv) cleaning of stone and brick	Building Research Station, Bucknalls Lane, Garston, Watford WD2 7JR, Herts.	J. B. Dick (Director)
	(v) atmospheric pollution of natural stone	Building Research Station	—
	(vi) durability of concrete	Building Research Station	—
	(vii) degradation of surface coatings	Building Research Station	—
	(viii)weathering of plastics	Building Research Station	—
	(ix) screening of research chemicals (submitted by member pharmaceutical companies) for activity against fungi and marine algae; testing of active compounds in paints	Paint Research Station	—
	(x) study of factors affecting dirt pick-up and removal from paint films; optimisation of paint selection and cleaning	Paint Research Station (D.O.E. Research Contract)	—
	(xi) study of mechanical properties and chemical changes of paints produced by weathering: development of simple durability test	Paint Research Station (joint project sponsored by Ministry of Defence, Navy Dept.)	— —
	(xii) evaluation of priming systems for aggressive conditions of bridge undersides: laboratory tests and exposure trials	Paint Research Station (research contract for Transport and Road Research Laboratory)	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(xiii) evaluation of research chemicals for ability to give long-life protection of cement and concrete against terrestrial growth	Paint Research Station (research contract proposal)	—
	(xiv) effect of air pollution, weather, light, on degradation of titanium dioxide pigments in various media	British Titan Products Co. Ltd., Carlton Weathering Station	—
	(xv) Effects of air pollution on aluminium building fittings and methods of prevention	N.P.L.	—
	(b) Effect of air pollution on high voltage (25 kV) insulators	British Railways Board, Research Dept., Blandford House, Melbury Terrace, London N.W.1	The Director
	(c) Study of vertical distribution of air pollution at the Post Office Towers in London and Birmingham, in connection with effect on P.O. equipment	Post Office, Purchasing and Supply Dept., Materials Section, Fordrough Lane, Birmingham 9	R. J. Feasey
	(d) Effect of climate and air pollution on corrosion of steel	British Steel Corporation, Corporate Laboratories and Operating Divisions	
Part 5. **Measurement Methods** (See also specific programmes in Parts 1 to 4)			
	(a) Study of physical and chemical characteristics of pollutants and development of analytical techniques	M.R.C., Air Pollution Unit	—
	(b) Dust analysis	M.R.C., Pneumoconiosis Unit	—
	(c) SO_2 recorders; development of methods for making measurements from aircraft; automatic data logging and telemetering; fluorine measurement; international standardisation of methods	W.S.L.	—
	(d) Development of instruments and techniques for the examination and monitoring of atmospheric pollutants at iron and steelmaking plant	British Steel Corporation, Divisional Laboratories	—
	(e) Development of methods for identification and determination of gaseous and particulate pollutants	Ministry of Defence, Chemical Defence Establishment	—
	(f) Commissioning of a mobile air pollution laboratory containing infrared spectrophotometric, mass spectrometric and gas chromatographic analytical equipment for continuous or intermittent monitoring of the gaseous, and heavy metal particulate components of the atmosphere	Ministry of Defence, Chemical Defence Establishment	—
	(g) Use of low temperature crystal infra-red spectroscopy for measuring amines and sulphides	University of Salford, Dept. of Chemistry and Applied Chemistry, Salford M5 4WT	Professor W. J. Orville-Thomas
	(h) Development of simple, rapid methods for determination of toxic substances in industrial atmospheres	Laboratory of the Government Chemist, Stamford Street, London S.E.1	Dr. H. Egan

Problem		Investigation	Organisation	Officer Responsible
	(j)	Development of X-ray fluorescence and polarographic methods for toxic metals in particulates, and specifition electrode methods for fluorides in factory emissions	Laboratory of the Government Chemist, Stamford Street, London S.E.1	—
	(k)	Simple, rapid, sampling and analysis of unburnt hydrocarbon fuels in aero gas turbine combustion products using: (i) current gas/solid chromatographic techniques (ii) flame ionisation detector techniques	National Gas Turbine Establishment, Pyestock, Farnborough, Hants.	—
	(l)	(i) Automatic continuous measurement of visibility by light scattering; automatic hourly filter tape equipment for collection of particulate matter, SO_2, ammonia and other pollutants	A.E.R.E.	—
		(ii) data logging equipment for measurement of meteorological parameters in association with the previous equipment; atmospheric stability indicator based on measurement of radon daughter products in the atmosphere	A.E.R.E.	—
		(iii) electron microscopy and diffraction for examination of atmospheric aerosols	A.E.R.E.	—
	(m)	Flue dust monitor development	C.E.G.B.	—
	(n)	Sampling and analysis of waste gases and particulate emissions from glass furnaces	British Glass Industry Research Association, Northumberland Road, Sheffield	Dr. R. G. Newton
	(o)	Precise measurement of uv radiation, of possible application to detection of atmospheric contaminants	N.P.L.	—
	(p)	Photometric analysis for sulphur oxides; chemiluminescence technique for NO_x; SF_6 tracer techniques for measuring pollutant dispersion	Esso	—
	(q)	Analytical effort in support of research projects; data handling for automotive emission studies	B.P.	

Organisation	Full name and address	Officer responsible
A.E.R.E.	Atomic Energy Research Establishment, Health Physics and Medical Division, Harwell, Didcot, Berks.	N.G. Stewart
B.P....	British Petroleum Co., Britannic House, Moor Lane, London EC2Y 9BU Petroleum Division, Research Centre, Chertsey Road, Sunbury-on-Thames, Middlesex	—

Organisation	*Full name and address*	*Officer responsible*
	British Steel Corporation, Research and Development Dept., Head Office, P.O. Box 403, 33 Grosvenor Place, London S.W.1	—
	Burmah-Castrol Co., Burmah Refinery, P.O. Box 14, Bridges Road, Ellesmere Port, Wirral, Cheshire LG5 4ES	
C.E.G.B.	Central Electricity Generating Board, Research Dept., Courtenay House, 18 Warwick Lane, London EC4P 4EB	F. F. Ross (co-ordinator)
Esso	Esso Research Centre, Abingdon, Berks.	—
	Gas Council, 4/5 Grosvenor Place, London S.W.1	—
L.G.C.	Laboratory of the Government Chemist, Cornwall House, Stamford Street, London S.E.1	Dr. H. Egan
	London University: University College, Dept. of Geography, Gower Street, London W.C.1	Professor T. J. Chandler
Met. Office	Meteorological Office, London Road, Bracknell, Berks.	Dr. B. J. Mason (Director General)
	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Head Office: Great Westminster House, Horseferry Road, London S.W.1	—
	Ministry of Defence, Chemical Defence Establishment, Porton Down, Salisbury, Wilts.	G. N. Gadsby
	Microbiological Research Establishment, same address	C. E. G. Smith (Director)
M.I.R.A.	Motor Industry Research Association, Lindley, near Nuneaton, Warwicks.	—
M.R.C.	Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical School, Charterhouse Square, London E.C.1	Professor P. J. Lawther
	Pneumoconiosis Research Unit, Llandough Hospital, Penarth, Glamorgan, Wales	The Director
N.C.B.	National Coal Board, Head Office: Hobart House, Grosvenor Place, London S.W.1	—
	Coal Research Establishment, Stoke Orchard, Cheltenham, Glos.	Dr. J. Gibson (Director)
N.P.L.	National Physical Laboratory, Teddington, Middlesex	J. V. Dunworth (Director)
N.E.R.C.	Natural Environment Research Council, 27/33 Charing Cross Road, London W.C.2	—
Paint Research Station	Research Association of British Paint, Colour and Varnish Manufacturers, Paint Research Station, Waldegrave Road, Teddington, Middlesex	The Director
Shell	Shell Research Ltd., Central Laboratories, Whitehall Lane, Egham, Surrey	—
	Thornton Research Centre, P.O. Box 1, Chester	—
W.S.L.	Warren Spring Laboratory, Dept. of Trade and Industry, P.O. Box 20, Gunnels Wood Road, Stevenage, Herts. SG1 2BX	Dr. A. J. Robinson (Director)

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The Warren Spring Laboratory of the Department of Trade and Industry

Warren Spring Laboratory carries out research on the nature and extent of air pollution, and on its prevention and abatement, in order to provide technical information necessary for the administration of clean air legislation, for town planning and the location of industry, and for research into the effects of air pollution.

The National Survey of Air Pollution

Ten years ago the existing scheme of daily observations of smoke and sulphur dioxide, made by Local Authorities and others in co-operation with the Warren Spring Laboratory, was extended in such a way as to form a National Survey from which valid conclusions could be drawn on the incidence of air pollution in urban areas throughout the United Kingdom. There are now, 31 March, 1970, 485 Authorities making these observations at 1,197 sites, and of these sites, 164 are in the country to give background information, for comparison.

In addition, monthly measurements of grit- and dust-fall are made with the British Standard Deposit Gauge by 192 Authorities at 675 sites. Monthly measurements are also made of the rate of reaction of sulphur compounds in the atmosphere with a standard lead dioxide surface, by 99 Authorities at 389 sites.

The Laboratory gives help and advice on all aspects of this co-operative investigation. In particular, newcomers to the scheme are advised on the selection of suitable sites for their instruments.

All data submitted to the Laboratory are collated and published as Annual Tables. For smoke and sulphur dioxide, these Tables give, for each site and for each month in the year, the average concentration, the highly daily concentration and the number of days when the concentration exceeded certain limits. The seasonal and annual average figures are also given. For grit- and dust-fall, and for the lead dioxide observations, the data for each month and the seasonal and annual averages are given.

Abstracts of papers and other information on air pollution are also published monthly.

These Annual Tables and Abstracts are available on request to all concerned with problems of air pollutions.

In addition, a series of Reports on the Investigation of Atmospheric Pollution published by H.M. Stationery Office, gave analyses of these results and an account of research on the measurement and abatement of air pollution.

The last in this series, the 32nd Report, brought the position up to date to 1966, and gave, in addition, an account of the changes in the administrative arrangements.

A series of Reports on the state of air pollution in the United Kingdom, as shown by the National Survey, is now in course of preparation. Drafts for the standard statistical regions are now under discussion with the Standing Conference (see below) and the first two, on the South-East Region, and on London, should be ready for publication this year. A definitive paper on trends in pollution over the last 10 to 20 years has been prepared using the whole of the National Survey data. Part of this is now in the press, and the remainder will be available shortly. This will ultimately form part of a General Introduction to the Survey Reports.

Standing Conference of Co-operating Bodies

All local authorities and other organizations who make measurements of air pollution, either as part of the National Survey or purely for their own local purposes, and who submit the data regularly to Warren Spring Laboratory for publication, are entitled to send representatives to the Standing Conference of Co-operating Bodies. Other bodies may do so on payment of a subscription. This Conference meets twice yearly to discuss matters of interest connected with air pollution. At 31 March, 1970, 438 bodies had appointed representatives to the Conference.

Automatic Instruments

A system has been devised whereby a sulphur dioxide recorder in the Warren Spring London Laboratory at Islington is plugged into the Post Office telephone and, on dialling the Islington number from the Stevenage laboratory, the reading of the recorder appears on a dial at Stevenage. If pollution is abnormally high at Islington the recorder there automatically dials the Stevenage laboratory, where it rings an alarm bell. Effort is now concentrated on the automation of recording stations so that the data from continuous or other recorders can be fed directly into a computer.

Town Planning Studies

In the past few years it has become increasingly apparent that while it is quite impracticable to control the amounts of sulphur oxides in the air by limiting their emission (as is done for smoke under the Clean Air Act), it is, nevertheless, possible to make great improvements by taking full advantage of natural dispersion processes. This can be done by the proper design of chimneys in relation to buildings and the proper siting of the various types of residential district in relation to each other and to industrial installations. A great deal of effort is being devoted to obtaining sufficient knowledge of the distribution and spread of pollution in urban areas to enable town planners to do their work satisfactorily from an air pollution point of view.

While the National Survey provides information on the distribution of pollution in urban areas this is being supplemented by special investigations. For example, a survey is being undertaken as part of the programme of the Warren Spring Laboratory by the Department of Geography of the University of Edinburgh to examine the build-up and dispersion of pollution over the city. The effects of topography, weather conditions, and the relation of industry to housing are being examined.

The general problem of the ventilation of cities is being studied in London by observations at various heights on the Post Office Tower. Laser equipment has been purchased and is now coming into operation to study the dispersion of particulate matter over cities.

A great deal of advice on the siting and heights of chimneys is given both to local authorities and to industry. This often requires tests of a model in a wind-tunnel, particularly when dealing with a complicated building complex or with difficult topography. A suitable tunnel has now been built at Stevenage so that this type of test can be undertaken. The tunnel will also be used to obtain more basic information on dispersion from chimneys.

Abatement of Nuisance from Malodorous Emissions

Now that such good progress has been made towards the removal of smoke from towns, various other pollutants that previously tended to be overlooked in the generally smoky air, are becoming more and more apparent and are causing lively complaint. These are the malodorous emissions from various types of industry, from the offensive trades and, most wide-spread of all, from motor vehicle exhausts. Warren Spring Laboratory is examining these problems to see where there may be possibilities of solutions.

The Central Electricity Generating Board

The main sources of air pollution from the operations of the Generating Board are the products of combustion of coal and oil. These are considered under the headings of: separation of solids from gases; dust measurement; disposal of solids; dispersion of gases.

Separation of Solids from Gases

Both the older and more modern pulverised fuel plants rely on electrostatic precipitation as the final or only stage of separation of particulate matter from flue gases. A research programme has revealed unexpected deficiencies in gas distribution, in rapping and in power supplies in some older plants. As soon as this research can be applied to individual plants, the deficiencies are being made good. Poor gas distribution leads to reduced efficiency because the greater efficiency of dust removal in a starved channel does not fully compensate for the reduced efficiency in an overloaded one; when, by means of velocity measurements and model techniques, the gas flow has been analysed, baffles can be designed and inserted to smooth the flow. Rapping impulses by means of which the collected dust is removed from the precipitator electrodes, have been found by actual measurement with accelerometers to be much attenuated if transferred from one member, such as a holding frame, to another, such as the plate or wire itself. Research on optimum electrical sub-division of the precipitator has shown the need for maintaining maximum power supply to each section and the importance of correct electrode spacing to reduce flashover.

Statistical analysis of the results of efficiency tests has shown the relative contribution to efficiency of such factors as size of precipitator, degree of sub-division, specific collecting area, power input, and the characteristics of the ash and the coal. It is clear that too low a sulphur content impairs collecting efficiency by making the particles electrically non-conducting, but no simple practical means of increasing the effective sulphur content of the ash from low-sulphur coals has been developed for routine application.

Dust Measurement

An important part of a dust-arresting installation is some means of informing the operator of any failure to function correctly. The pollution by dust at ground level is caused in the main by particles in the range from 20μm upwards, and an instrument has therefore been developed known as the CERL Dust Monitor which gives a continuous record of the emission of these coarser particles which are not recorded by instruments used to measure the emission of smoke. The CERL Dust Monitor has recently been redesigned to give it the maximum reliability under power station conditions and the Mark II instrument is now commercially available from two firms and is being tried out in other industries including cement and iron works. The nuisance from excessive emissions is a function of total output over a period of time, and integrators for the sum of the readings of all instruments in a power station over an eight-hour shift period are under development.

With sufficient sensitivity, combined with accuracy in regard to the zero reading for clean gas, a smoke meter can give a useful indication of the dust content of flue gases. Such optical instruments are mainly influenced by the finest particles, but if the dust grading does not vary greatly at the outlet of a precipitator the readings of such instruments may correlate sufficiently well with dust-arresting performance to serve the purpose of an operational guide. An instrument which can be inserted from one side of a duct and removed for a manual check of the zero has been developed and is commercially available.

Because it was thought that the standard deposit gauge had a limited application to modern dust problems, a new type of gauge has been developed for measuring dust in the field known as CERL Directional Dust Gauge. This has been used in routine measurements around a number of modern power stations and its directional characteristics are considered to be of considerable assistance in the interpretation of measured results. Its design is being modified to make it as cheap as possible to produce and is being incorporated in a British Standard Specification which will be published shortly.

Ash Disposal

Local air pollution can arise where dust which is handled or dumped is allowed to dry. Economical techniques of surface treatment are under investigation. There is a particular problem with cenospheres (floaters) on ash lagoons. These can dry on the surface layer and be picked up by the wind. A number of methods for dealing with this difficulty are now being investigated, from immobilising them *in situ* to harvesting them for industrial use.

Dispersion of Gases

Eight-part daily SO_2 samples are used routinely around power station sites for a number of years before and after commissioning of the stations. In addition a number of stations have been intensively instrumented using in each case about two dozen continuously recording SO_2 instruments and full meteorological instrumentation. The SO_2 recorders were developed about 10 years ago at CERL and have been successfully used in these surveys. The surveys have given excellent support to theoretical predictions and to the effectiveness of tall chimneys in controlling large-scale emissions of flue gas, as well as providing new knowledge on the particular influence of inversion layers above and below the chimney top. One important aspect of chimney height is now seen to lie in the proportion of inversions which are penetrated by the flue gases.

The Tilbury and West Burton investigations have been concluded. A further survey of this type is nearing completion at Eggborough which is the first 2000MW power station employing a single chimney. This survey has 25 SO_2 recorders and meteorological measurements which for the first time give details of atmospheric conditions up to 1,250 feet from the surface of the Earth. The use of a laser to measure the height of a plume, even though it is invisible to the eye, has been developed for some years at the Tilbury survey. This will continue to be used at Eggborough and its use will also be developed to study the temperature profile of the atmosphere in the range immediately above 1,250 feet. Observations of plume rise and ground level SO_2 concentration will also be made in due course at the Drax power station in Yorkshire, which has a single 850ft chimney designed for 4000MW of generating plant.

Other Potential Problems

In recent years prominence has been given to claims by certain European countries that SO_2 emissions several hundred miles from their sources can adversely affect forests, agriculture and rivers by producing "acid rain". It has been widely acknowledged that insufficient scientific data are yet available to confirm or deny these claims and an international study of long-distance drift of SO_2 has been started under the auspices of OECD. The Generating Board is participating in the UK contribution to this work and in addition is making further studies of some relevant factors; such as the chemical reactions of SO_2 at low ambient concentrations and the rates of absorption of SO_2 at the surface of the earth. In a related field the extent to which low concentrations of atmospheric SO_2 may assist in meeting the essential sulphur requirements of growing plants is also under consideration.

The Atomic Energy Research Establishment

Objectives

The Harwell programme is concerned with the atmospheric chemistry and life history of major air pollutants. The movement of trace elements from the atmosphere into the general environment is also studied.

Tees-side survey

The study has been completed of the occurrence of mist in the Tees-side area and its relation to meteorological conditions and pollutant emissions. Several mist episodes occurred during the investigation in association with natural sea-mist, affecting much of the north east coast of Britain. These episodes were made worse on many, though not all, occasions by the presence of ammonium sulphate formed in the atmosphere by reaction between ammonia emitted from chemical plant in the area and sulphur dioxide from combustion of fossil fuel. The mean levels of ammonium sulphate on Tees-side were no greater than expected for an area of comparable industrialisation elsewhere but it was concluded that as long as emissions of ammonia and sulphur dioxide were sufficiently high the episodes of polluted fog with high peak concentrations of ammonium sulphate were likely to occur. Much has been done recently to reduce emissions of ammonia and sulphur dioxide and no serious episode of polluted fog occurred since the investigation was completed at the end of 1970.

Life cycle of sulphur dioxide in the atmosphere

Deposition of sulphur dioxide to ground

Deposition of sulphur dioxide to the ground is thought to be of great importance in relation to the long-range travel of sulphur dioxide. One of the methods by which this is being studied depends on the fact that if a gas is absorbed at the ground surface there is an associated gradient of concentration with height. The flux of gas to the ground can be estimated if its concentration in air and also the wind speed are measured at two or more heights.

Laboratory studies of oxidation of sulphur dioxide to sulphate

This work is relevant to the long-range travel of sulphur in gaseous and particulate form, and to the problem of acid rain. The experiments have shown that the oxidation of sulphur dioxide in cloud or fog droplets is normally much faster than in the gaseous phase (there may be exceptional rates of gas phase oxidation during episodes of photochemical smog). The role played by metal catalysts (iron and manganese) has been investigated in laboratory experiments, both in systems containing droplets of concentrated electrolyte resembling fog and haze and in those containing large amounts of liquid water phase such as occur in cloud and rain droplets. The effect of ammonia on the rate of oxidation whether containing metal catalysts or not has also been investigated.

Calculations from the laboratory results of the amount and rate of oxidation expected under typical atmospheric conditions show that these oxidation mechanisms account only with difficulty for the amount of oxidation actually observed. It appears necessary to invoke further oxidation mechanisms to explain the observed rates and investigations on this continue.

Studies of the photochemical oxidation of sulphur dioxide to sulphate are also being pursued using sulphur-35 as tracer. From the results obtained it was concluded that the sulphuric acid aerosol produced in the photochemical reaction of sulphur dioxide in the presence of NO_x and olefins results wholly from oxidation of sulphur dioxide by photochemically generated ozone in the presence of olefins. This reaction probably constitutes a significant sink of sulphur dioxide in the troposphere.

Photochemical smog

Field studies confirmed the high rate of photochemical oxidation of sulphur dioxide found in the laboratory experiments referred to in the previous paragraph. During the summer of 1971, measurable quantities of photochemical ozone were observed in Southern England, formed by a smog reaction of the Los Angeles type arising from unsaturated hydrocarbons and oxides of nitrogen, mainly emitted from motor vehicle exhausts. Significant oxidation of sulphur dioxide to sulphuric acid occurred at the same time when meteorological conditions were such that only the photochemical reaction could have been important.

Continuous measuring devices for ozone

The ozone measurements referred to in the previous paragraph were made with an instrument based on the chemiluminescent reaction between ozone and ethylene. The light emitted in the reaction is detected on a photomultiplier. The instrument gave readings which were directly proportional to the ozone concentration in the range 0–2 ppm and were unaffected by sulphur dioxide, nitrogen dioxide and water vapour.

Effects of sulphur dioxide on growth of rye grass

Substantial economic losses may occur when S23 ryegrass is grown in areas of high coal-smoke pollution. To study whether sulphur dioxide is the toxic factor producing the depression in yield *S23 Lolium perenne* was grown for prolonged periods in an atmosphere with a sulphur dioxide concentration typical of polluted districts. Although many aspects of the problem have still to be investigated the results so far suggest that these sulphur dioxide concentrations can depress seriously the yield of *S23 Lolium perenne*.

Automatic cloud nucleus counter

Cloud nuclei are particles which can condense water and thus become droplets at the supersaturations, up to one per cent or so, which can exist in the atmosphere. The ability of a particle to condense water depends on its size and its nature, so to determine a spectrum of the cloud nuclei concentration it is therefore not sufficient to measure the particle size distribution of the cloud nuclei but it is necessary to determine the number of nuclei present which are capable of condensing water at each of a series of supersaturations. An automatic instrument has been built to fulfil this task. This consists of a small diffusion cloud chamber in which cloud nuclei are made to grow to predetermined supersaturations which can be varied as desired. Light scattered by the droplets formed is seen by a photomultiplier. The instrument was used over the Greenland ice-cap and showed that, even there, a significant contribution to the cloud nuclei population resulted from man's activities.

Trace elements in air and rainwater

Trace elements in the atmosphere can be considered as (a) nutrients, (b) potentially toxic pollutants and (c) as tracers of transfer mechanisms. The background levels of trace elements and the natural and unnatural variations about these levels are being measured to observe the passage of trace elements through the environment. In 1970-71 an exploratory programme was established using a relatively unpolluted site near Lake Windermere. This has been extended to a seven-station (non urban) national study of some thirty trace elements in airborne dust, rain and dry deposition. A similar but more intensive environmental programme has been started in the Swansea area (seven stations).

The Medical Research Council's Air Pollution Research Unit

The following notes describe briefly the current work on air pollution being done by the M.R.C. at St. Bartholomew's Hospital Medical College. For convenience the work is described in outline under various headings but it will be realised that the method of presentation does not mean that the topics are being investigated in isolation. The various investigations are highly integrated and it should be stressed that there is excellent liaison between the M.R.C. Air Pollution Unit, other M.R.C. units and outside bodies. The unit has been designated as the World Health Organisation International Reference Laboratory on Air Pollution.

Chemistry and Physics

As a prerequisite to the proper study of the effects of pollution much work is still being done on the chemical and physical nature of pollutants and methods for their determination.

Optical Assessment of Particulate Pollution

Optical methods are widely used to assess airborne particulate matter. In particular, smoke is commonly measured by the soiling of filters, but the techniques used are not the same everywhere and the measurements are interpreted on a purely empirical basis. It is therefore often difficult to compare results from different parts of the world, and even in this country to compare samples taken at the same place at different times, because the blackness of the particulate matter in the air is changing all the time as the Clean Air Act takes effect. The optics of the assessment of soiling, and the effect of the geometrical distribution of smoke particles collected on filters on the results obtained, have been studied, with a view to gaining a better understanding of the phenomena affecting the measurements. This understanding is a necessary preliminary to comparison of results obtained by different workers and to the development of methods better suited to present needs. Further work on the optics of particles deposited on glass slides is under way.

Studies on Carcinogens

Our interest in 3:4-benzpyrene and other polycyclic hydrocarbons is declining since not only are their concentrations in air now decreasing but the evidence that they are associated with lung cancer is much weaker than it was some years ago. Some studies on the stability of these hydrocarbons have shown that some of them appear to be destroyed by ultraviolet light and nitrogen dioxide. Investigation into the sources of polycyclics has shown that the relative proportion of certain hydrocarbons can vary; using a ratio of coronene to 1:2-benzpyrene (two stable hydrocarbons) it has been possible by analysing samples of collected smoke to identify sources of hydrocarbons such as coal fires and motor vehicles. A study into the production of hydrocarbons from burning fuels has shown that the above hydrocarbon ratio increases markedly as the combustion efficiency increases.

Asbestos

Asbestos can no longer be considered to be merely a pollutant of industrial atmospheres; recent work on the prevalance of mesotheliomas has shown the need to study it as an urban pollutant. Samples of asbestos which have been shown to be highly carcinogenic to rats have been examined for organic material. A number of constituents have been identified including trace amounts of 3:4-benzpyrene, and paraffinic hydrocarbons, a high proportion of which latter compounds come from the polythene bags with which the asbestos has been in contact, and a quinoid oxidation product of an anti-oxidant present in the polythene. The biological significance of contaminating substances associated with the asbestos has yet to be assessed.

Some preliminary studies on bulk samples of smoke collected in the City have been carried out in which the samples are extracted with organic solvents and ashed at low temperatures so that they can be examined with an electron microscope for asbestos fibres. A few asbestos-like fibres have been detected; examination using electron diffraction techniques is planned to help with the identification of such fibres.

Acid Particles

Acid particles, which may be of clinical significance, are very common in town air. Their source at times of low pollution appears to be the efficient combustion of fuels; past records show that at times of high pollution synthesis of acid takes place and that high concentrations of sulphur dioxide and smoke occurring together are important for the formation of much particulate acid.

Since sulphur trioxide vapour and sulphuric acid when inhaled are likely to have different physiological effects, some laboratory experiments are being carried out to determine how long the vapour can exist as such in air before it is converted to sulphuric acid.

Carbon Monoxide

Because of the many sources of carbon monoxide, its varying concentrations in air, and the fact that its absorption depends on exercise and time, the measurement of carboxyhaemoglobin is greatly to be preferred to measurement of CO in air. The simpler indirect methods of measuring carboxyhaemoglobin such as the measurement of alveolar air are being tested; this involves simply analysing carbon monoxide in exhaled air after breath-holding.

Electron Microscopy

Work is continuing on the depiction and identification of particulate pollutants by electron microscopy and electron diffraction, special attention being paid to asbestos. We have devised a method for treating samples of beer so that their residues can be examined for asbestos fibres using the electron microscope. This preparative technique could also be used for the study of asbestos fibres in samples of solid air pollutants.

Development of Instruments and Apparatus

An oscillating glass slide for use with the cascade impactor and thermal precipitator is under development. It is designed to obtain larger dust sample traces for the work on the optics of particles deposited in glass slides.

Equipment is to be made for the generation of monodisperse aerosols which will include an automatic dual syringe drive.

Apparatus for the study of surface active materials is being developed.

The improvement and automation of lung function measurements is being studied with special reference to ways in which a digital computer may be used to accept and process signals from the whole body plethysmograph and other apparatus.

Physics of the Lung and Measurement of its Function

The fundamental study of the lung as a physical system is enabling us to reassess the methods of measuring its function in health and disease. In the past, studies to determine the physiological effects of environmental pollutants have been hampered by the lack of a very sensitive test to assess the effects of respiratory insult, and as part of the search for a more refined technique, we are developing new methods of assessing respiratory function. The analysis of continuous respiratory waveforms is being studied using the unit's own on-line digital computer to process the physiological data.

Studies of Acute Effects of Inhalation of Pollutants

Very many combinations of gases and aerosols of different composition have been inhaled in order to study their effects on airway resistance and gas diffusion. As yet no consistent responses have been seen to follow exposures to realistic concentrations in the laboratory.

Daily measurement of airway resistance following exercise has shown some correlation with pollution and this is being studied carefully.

Daily measurements of simple indices of pulmonary ventilation have been made for a five-year period on healthy volunteers but no consistent relation with pollution has been found. Measurement of peak expiratory flow rate on selected bronchitic patients continue and there is an indication that sensitivity to high peaks of pollution decreases as the winter goes on.

We are making long term cohort studies of lung function and respiratory symptoms on medical students to see if early signs of the development of chronic bronchitis is related to pollution, smoking habits, changes in residence, age and athleticism.

Carbon Monoxide

Following the development of the micro-method for determining CO in blood (mentioned above) surveys of blood levels have been made in people exposed occupationally or experimentally to traffic. These have shown, so far, that levels above four per cent saturation with carboxyhaemoglobin are rarely attained in non-smokers but levels higher than this (not uncommonly greater than 10 per cent) are frequent in smokers. These surveys are being extended.

Experimental work is being done on the possible effects of carbon monoxide, producing a saturation of up to 10 per cent, on the performance of fine tasks and on vigilance. So far the results have shown no perceptible effects of such saturations on flicker and flutter fusion thresholds. Work on more complex tests is being done.

Physiology, Bacteriology and Histology

Effect of Irritant Atmospheres in the Chemical Industry on Bronchial Mucosa

We have arranged that samples of lung and bronchi from post mortem and biopsy material be sent to us for histological examination to assess the degree of mucosal hypertrophy. The material comes from I.C.I. employees and is examined "blind" in that their occupational exposure to irritants is not known. The work is designed to test the hypothesis that chronic bronchitis is not mainly caused by exposure to such simple chemical irritants as SO_2.

Bacteriology, Effects of Pollutants on Lung Flora

It has been suggested that pollution in town air is responsible for the greater prevalence of chronic bronchitis in towns compared with country districts. As part of our investigations into the possible relationship between air pollution and bronchitis we have been studying the effects (in vitro) of particulate pollutants collected from London air on the growth of some organisms found in the respiratory tract—Strep. viridans and Staph. aureus—and those commonly recovered from the sputum of patients with chronic bronchitis—Strep. pneumoniac and H. influenzae. Our experiments have shown that solid pollutants can not only inhibit bacterial growth on blood agar plates but they can also cause growth stimulation of H. influenzae. A chemical separation of pollutants has shown that the growth inhibitor is mainly in the water soluble fraction and the stimulator is in the organic soluble fraction. Studies so far suggest that the factors present in pollutants are not capable of replacing "X" or "V" as growth requirements but probably act indirectly through an effect on the medium.

Epidemiology

Our efforts to determine whether the marked improvement in pollution conditions in London during recent years have led to any corresponding improvements in health are continuing. There is now little evidence of any association between daily death rates, hospital admissions and pollution. This is due largely to the absence of periods of high pollution in recent years; we would not expect smoke to reach high values any more but there is good reason to believe that high concentrations of sulphur dioxide would still occur in temperature inversions. It may be however that the absence of a blanket of smoke and the increased turbulence introduced by tall buildings has reduced the risk of temperature inversions persisting through the daytime hours. Our latest "diary" study, in which patients who had responded consistently to changes in pollution in an earlier winter were again asked to record changes in their conditions on a daily basis, has also failed to demonstrate any marked effects of pollution.

These results are encouraging, but we could not claim yet that the acute effects of pollution in London have been eliminated. We may merely have been lucky with the weather in recent winters, and the examination of daily death rates and hospital admission data will continue.

Studies on chronic effects also show encouraging signs; bronchitis mortality is beginning to decline again, particularly in London, and although the improvement may be due partly to changes in smoking habits and to improved therapy the situation is being watched carefully in relation to changes in pollution.

Studies of the epidemiology of lung cancer continues and, as evidence accumulates and is analysed, it is becoming increasingly apparent that cigarette smoking is of overwhelming importance as the main cause of the disease and the role of air pollution would appear to be minimal.

An earlier study had shown that chest illness was commoner in children who had lived in polluted environments, and further work is now in progress to determine whether exposure to urban air pollution in infancy has any detectable effect on lung function in later life.

Extensive use is made of large-scale computing facilities for all this work, and files of data are maintained on magnetic tape.

The National Industrial Fuel Efficiency Service Ltd.

N.I.F.E.S. Ltd. provides a complete consulting engineering service covering all aspects of energy utilisation and associated pollution problems. Instrumented surveys are used to show by precise measurement how systems can be operated efficiently at minimum cost, and a regular service is provided to establish and maintain maximum efficiency. A full consulting service is provided for the design and specification of new plant and ancillary services and a comprehensive commissioning and testing service is also available.

Comprehensive advice and assistance are available in connection with the implementation of the Clean Air Act and with other types of problem, including noise abatement and water pollution. Measurements of grit and dust emission as required by the Act can be undertaken. A complete design service is provided for Refuse Incineration.

Training courses for boiler operators and all personnel concerned with fuel and energy applications are arranged by request, and residential courses are also organised on oil and gas firing.

Imperial Chemical Industries Ltd.

The Company is continuously developing instruments for testing atmospheric contamination. Much of the interest is in instruments for use within our factories for efficient pollution control and to ensure that we can assess the quality of the environment in which our workers operate and that we do not waste valuable materials. This work has been extended to monitor pollution outside the factory perimeters and at one location we have found the services of an Odour Identification Panel to be most useful. The panel comprises five members of our staff whom we found, by carrying out a survey, to be skilled in identifying odours. After further special training in odour recognition, they have helped us to trace leakages taking place from equipment at high levels which were completely undetected on the plant itself.

We believe that much of the general research work is best done in a university environment. As an example of our interest we are currently assisting Lancaster University where our Agricultural Division supports a CAPS Award—a study on the synergistic effects of NO_2 and SO_2 on plant life. We also finance a fellowship at the University of Manchester Institute of Science and Technology, currently held by a former member of our Brixham Laboratory staff, concerned with an investigation of processes for the incineration of industrial waste materials with special reference to plastics.

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Section 4

Recent Books, Papers and Reports

A Selected List

All available on loan from the Society's library

Advances in Environmental Science and Technology. Volume Two. Pitts, James N. and Metcalf, Robert L. (editors) Wiley/Interscience, 1971. (£8.50)

Air Pollution Control, Part One and Part Two. Strauss, Werner (editor). Wiley/Interscience, New York, 1971. (£9.50 each)

Air Pollution Control in Transport Engines. Institution of Mechanical Engineers. Papers presented to a Symposium in Solihull, plus report of the discussion. 1971. (£13.00)

107th Annual Report of the Alkali &c. Works, 1970. Chief Inspectors, H.M.S.O. 1970. (65p)

Annual Report of the Scientific Adviser, 1970. Greater London Council, Scientific Branch: Director-General's Department. (£1.20, postage extra)

Battle for the Environment. Aldous, Tony. Fontana/Collins, 1972. (45p)

Can Britain Survive? Goldsmith, Edward. (editor) Tom Stacey, 1971. (£3.00)

Catalytic Conversion of Automobile Exhaust. McDermot, John. Noyes Data Corporation, New Jersey, U.S.A. 1971. (36 dollars)

Clean Air Conference, Folkestone, 1971. Proceedings. N.S.C.A. (£2.50)

Consumers' Guide to the Protection of the Environment. Holliman, Jonathan. Pan/Ballantine, in association with Friends of the Earth. 1971. (40p)

Dispersion and Forecasting of Air Pollution. World Meteorological Organisation, Technical Note No. 121, 1972.

The Eco-Activists. Allaby, Michael. Charles Knight & Co. Ltd. London, 1971. (£3.00 hard cover, £1.25 soft cover)

Environmental Health Report, 1970. Association of Public Health Inspectors, 19, Grosvenor Place, London, S.W.1. (25p)

The Environment in Israel. Marinov, Uri and Harel, Eitan. (editors) 2nd Edition. The Israel National Committee on Biosphere and Environment. Jerusalem, 1972.

Environmental Legislation. Hurley, William D. Charles C. Thomas, Illinois, U.S.A. 1971. (6.50 dollars)

Fundamentals of Industrial Ventilation. Baturin, V. V. Third Enlarged Edition. Pergamon, 1972. (£12.00)

Guide to the Reduction of Smoke and Odor from Diesel-powered Vehicles. U.S. Environmental Protection Agency, Office of Air Programs, Research Triangle Park, North Carolina, 1971. (30 cents)

Health Hazards of Lead. U.S. Environmental Protection Agency, 1972.

The Internal Combustion Engine. Has it a Future for Road Transport? Williams, C. G. University of Surrey Inaugural lecture to the Mechanical Engineering Society. 1972.

Introduction to the Scientific Study of Air Pollution. McCormack, B. M. (editor) D. Reidel Publishing Company/Dordrecht—Holland. 1971.

National Survey of Air Pollution, 1961 - 1971. Volume One. General Introduction; United Kingdom (a summary); South East Region (excluding London); Greater London Area. Department of Trade and Industry. Warren Spring Laboratory. H.M.S.O. 1972.

The New Battle of Britain. A Conservation Handbook and Directory. Wallis, H. F. Charles Knight & Co. Ltd. London, 1972. (£2.00 hard back, 75p soft cover)

Nitrogen Oxides Emission Control. Lawrence, A. A. Noyes Data Corporation, New Jersey, U.S.A. 1972. (36 dollars)

Pollution: Nuisance or Nemesis? Working Party on Control of Pollution. (Chairman Sir Eric Ashby) H.M.S.O. 1972.

A Provisional Code of Practice for Disposal of Wastes. The Institution of Chemical Engineers. (£2.00)

Royal Commission on Environmental Pollution. (Chairman: Sir Eric Ashby) Second Report: Three Issues in Industrial Pollution. H.M.S.O. 1972 (18p)

Spring Seminar, Manchester, 1972. Papers. N.S.C.A. (£4)

Sulfur Dioxide Removal from Waste Gases. Slack, A. V. Noyes Data Corporation, New Jersey, U.S.A. 1971. (36 dollars)

For further new publications see "Book Reviews" and "New Additions to the Library" in the Society's journal "Clean Air".

Films and Filmstrips

Following is a list of films and filmstrips on air pollution and its prevention, fuel efficiency, environmental protection, etc. Application for the loan of films should be made to the issuing organisation, referred to in the list by its initials, the key to which is given at the end of the list. The films are available free unless otherwise stated. Two - three weeks advanced notice of hire should be given. The running time in minutes is shown. Unless otherwise indicated, the films are available in both 16mm and 35mm sizes, with sound.

The Society welcomes information on other films suitable for inclusion in future editions of the Year Book.

Films

GENERAL AND EDUCATIONAL

The First Mile Up. The experience of cities in North America making vigorous efforts to combat air pollution. Smoke prevention in Toronto. Particularly well illustrated. 16mm. 28mins. C.F.C. (hire fee £1.60)

And on the Eighth Day . . . Outstanding programme on the pollution of our environment, in four sections: Water; Air; Earth and Fire. A serious and challenging film. (A Thames T.V. production) 60mins. Colour. C.F.C. (hire fee £5.50)

The Choice. The film's main themes are earth, fire and water. It concentrates on what is being done and what can be done, to preserve the environment. Science and technology have already provided most of the answers. Co-operation between industry and the community has already demonstrated that it can yield worthwhile results. Future success will depend on continuing investment, and above all a wider more vigorous co-operation. 29mins. Colour. I.C.I.

Environment in the Balance. The film shows how geological, topographical and social developments in Britain have helped shape our environment and discusses the problems of industrial expansion, population growth and pollution. Given the technological ability to safeguard the future, the issues depend on us all, as individuals. 16mm. 30mins. Colour. SM/BP (Hire fee 25p)

The Shadow of Progress. This film won the Airlie Foundation Trophy at the Second International Clean Air Congress in Washington, 1970. It was considered the best general film about the environment. 16mm. Colour. SM/BP (hire fee 25p)

A Breath of Spring. The film deals with the advantages of air conditioning. It investigates the effect of air on people—its effect on their comfort, convenience and concentration. It is not technical and although it starts off with some excellent shots of air pollution in our city streets, it is mainly intended for screening to owners and managers of shops and restaurants. It was made for the Air Conditioning Advisory Bureau, which is sponsored by the Electricity Council. 16 mm. 18 mins. Colour. E.C.

Conservation and Balance in Nature. A comprehensive picture of man's relationship to his environment, and the inter-relationship of the living things themselves. Examples of various environments and different kinds of living things are shown, and also the use of pesticides and chemicals, and the film ends by stressing man's responsibility to use wisely his natural environment. 18mins. Colour. C.F.C. (hire fee £1.10)

DOMESTIC AND SMOKE CONTROL AREAS

Clean Air. Deals with air pollution and shows how modern methods of domestic heating meet the requirements of the Clean Air Act. 16 mm. 21 mins. Colour. SM/BP (hire fee 25p) and C.F.L.

People Like Us. An amusing film in which three typical houses are taken apart at the seams, and set to rights with solid fuel heating throughout. 15 mins. Colour. N.C.B.

Home and Warm. Deals with the modernisation of an older type house and the installation of modern solid fuel central heating. 10 mins. Colour. N.C.B.

Welcome Home. Demonstrates the modern equipment available for burning solid smokeless fuels, and the range of these fuels available. The film also explains the Clean Air Act, how it works, and how solid fuel meets its requirements. 22 mins. Colour. N.C.B.

Group Heating in Paisley. District heating claims great advantages over the more conventional domestic heating particularly in new development areas as is shown in this study of how a large complex of flats in the Scottish town of Paisley is heated by solid fuel from a single central boiler plant. 7 mins. Colour. N.C.B.

District Heating in Leicester. Shows how new residential developments are supplied with heat and hot water from their own central boiler plant. 10 mins. N.C.B.

Billingham Group Heating Scheme. A solid fuel group heating scheme serving mixed industrial, commercial and residential premises in a new town extension at Billingham, Co. Durham. 14 mins. Colour. N.C.B.

Gas in Modern Housing. Stresses the need to incorporate clean air principles in new house design. It shows in some detail the flexibility and labour-saving advantages of gas for space heating, domestic hot water, incineration and other purposes. 16 mm. 18 mins. Colour. G.C.

Project Halton Fields. Features a typical modern housing estate to show new developments in domestic oil-fired central heating on a district level and indicates to developers and architects the advantages to them and to potential house-buyers of new systems and techniques. 16 mm. 20 mins. Colour. SM/BP (hire fee 25p)

HEALTH

It Takes Your Breath Away. A review of the causes of "dirty air" as produced by domestic and industrial smoke, traffic, etc. The effect on the lungs of living in this type of atmosphere is briefly shown and the film is of value to Public Health Workers as a means of ramming home the ill effects of a smoky atmosphere. 16 mm. 10 mins. B.M.A.

VEHICLE POLLUTION

You and Your Diesel. The importance of maintenance for diesel-engined lorries and tractors. 16 mm. 35 mins. Colour. SM/BP (hire fee 25p)

Horsepower and Hydrocarbons. The California Motor Vehicle Control Board explain the nature and extent of emission problems from the motor car. The alternatives to the petrol driven car are examined, as are methods of reducing levels of emission. The first film to approach all aspects of the problem fully. 16 mm. 22 mins. Colour. N.S.C.A.

FUEL, POWER AND INDUSTRIAL

No Tipping. Illustrates the "System Dusseldorf" approach to refuse disposal and shows the threat to clean air posed by traditional methods of refuse disposal. 16 mm. 14 mins. Colour. M.B.T.

Incineration—The Burning Question. Shows another method of refuse disposal and pinpoints the national problem of 17,000,000 tons of refuse needing to be disposed of annually. 30 mins. Colour. J.T.

Fluidised Coal Carbonisation and Hot Briquetting. There are not enough natural smokeless fuels. Coke is an excellent manufactured fuel but can be made only from certain coals. This film describes the work of the N.C.B. Coal Research Establishment at Stoke Orchard leading to the development of a new smokeless fuel for open fires. (For technically minded audiences) 12 mins. N.C.B.

Homefire—Smokeless Fuel for the Open Fire. Based on small-sized smoky coal, a new smokeless fuel has been developed by the N.C.B. which burns in an open grate and gives a good flame. The manufacture of these smokeless briquettes is explained non-technically. 12 mins. Colour. N.C.B.

Coal: Our Wasting Asset. Deals with fuel efficiency, fuel conservation and the problem of smoke. Although over twelve years old, this film, which was a special issue of Mining Review, still has an important message about the proper use of solid fuel. 10 mins. N.C.B.

Saharan Venture. The story of the transportation of methane gas from the Sahara to help provide Britain with abundant supplies of clean fuel. 16 mm. 28 mins. Colour. G.C.

The Methane Story. A longer version of the above film, made for the benefit of specialists. It gives a chronological account of the entire scheme, with emphasis on the methods and techniques employed. 16 mm. 28 mins. Colour. G.C.

Power in Trust. Electricity plays an important role in all our lives. Through the eyes of a schoolboy the generation of electricity in a modern power station is explained. 15 mins. Colour. M.R., C.E.G.B.

Combustion and the Chain Grate Stoker. Shows chemical and physical principles of coal, combustion, and their application in chain grate stoker. 16 mm. 25 mins. B. & W.

This Age of Steam. Emphasizes the growth of world population, rising industrialization and improving standards of living, which result in a rapidly increasing demand for power, chiefly electrical power. 16 mm. 35 mins. Colour. B. & W.

Industrial Electric Heating. Describes the use of electricity for industrial heating processes. 30 mins. Colour. E.C.

Combustion. An instructional film for service engineers and boilerhouse staff. Includes an introduction to elementary chemistry and the reason for the production of smoke. A simple way of measuring the carbon dioxide content and the method of carrying out a complete gas analysis with an Orsat apparatus is explained as well as how draught can be measured and controlled in an industrial boilerhouse. 16 mm. 31 mins. Colour. H. & B. (hire fee £3)

Pulverized Fuel. Deals with principles of pulverized fuel use. 16 mm. 40 mins. B. & W.

The Properties of Coal. Shows how the properties of coal vary according to the areas where it is mined, and how these characteristics affect its behaviour during combustion. The film gives an explanation of swelling number and shows how various types of coal suit different types of stokers. 16 mm. 20 mins. Colour. H. & B. (hire fee £3).

Sea Born Treasure. Vividly highlights the background to the discovery of the first major new indigenous source of power since coal; the progress made in bringing it ashore and the isolation and hardships endured by the crews of the drilling rigs. Touches upon the connection this discovery of gas in the North Sea and the effect its distribution may be expected to have on the national economy and the citizen. 16 mm. 25 min. Colour. G.C.

Gas Flow. Research into the effects of various types of flue baffles and bridge heights in a Lancashire Boiler and an Economic Boiler. 16 mm. 7 mins. H. & B. (hire fee £3).

Air Flow. A research film showing a series of experiments with the Hydraulic Flow Model applied to the Chain Grate Stoker. The Flow Model is used to demonstrate the conventional method of supplying air to a Chain Grate Stoker with a Dual Zone System. 16 mm. 9 mins. H. & B. (hire fee £3).

Synchromatic. Begins with a descriptive sequence of the hopper type Synchromatic Underfed Stoker. The second part deals with the bunker type stoker with the transfer box which can be set at any angle to the axis of the boiler and at any inclination to the ground. The final part of the film is devoted to the Stoker fitted to a boiler under fire. 16 mm. 12 mins. Colour. H. & B. (hire fee £3).

How Steam is Produced. Describes the production of steam in power stations using coal, oil, and nuclear fuel. Animation is used extensively to show the complete sequence of operations from the arrival of the fuel to the output of electricity. 18 mins. Colour. C.E.G.B.

How Electricity is Made. Describes the making of electricity for the nation's needs and its transmission in bulk to all parts of the country. Various fuels are used to make steam drive generators. The principles are illustrated in the film. 21 mins. Colour. C.E.G.B.

Key to Issuing Organizations:

B.M.A.—British Medical Association Film Library, Tavistock Square, London, W.C.1.

B. & W.—Babcock & Wilcox Ltd., Babcock House, 209 Euston Road, London, N.W.1.

C.E.G.B.—Central Electricity Generating Board, Film Library, Sudbury House, 15 Newgate Street, London, EC1A 7AU.

C.F.C. — Concord Films Council, Nacton, Ipswich, Suffolk.

E.C.—Electricity Council Marketing Department, Trafalgar Buildings, 1 Charing Cross, London, S.W.1.

G.C.—The Gas Council, 6-7 Great Chapel Street, London, W.1.

H. & B.—Hodgkinsons Bennis Ltd., Little Hulton, Worsley, Manchester.

I.C.I.—I.C.I. Film Library, Thames House North, Millbank, London, S.W.1.

J.T.—John Thompson Ltd., Ettingshall, Wolverhampton, Staffs.

M.B.T. — Motherwell Bridge Tacol Ltd., Green Dragon House, 64-70 High Street, Croydon, Surrey.

M.R., C.E.G.B. — Public Relations, Midlands Region, C.E.G.B., Haslucks Green Road, Shirley, Solihull, Warwickshire.

N.C.B.—National Coal Board, Film Branch, 26-28, Dorset Square, London, N.W.1.

SM/BP — Shell-Mex and B.P. Film Library, 25 The Burroughs, Hendon, London, N.W.4.

FILM STRIPS

The following film strips are available on loan from the Society, except for the ones marked * which denotes for purchase only.

Air Pollution and You. Traces sources of air pollution and illustrates methods of control in 31 captioned frames. Colour, plus lecture notes. (Produced by Current Affairs Films of New York.)

Air Pollution. General survey of problems, methods of measurement, etc., prepared in consultation with the Association of Public Health Inspectors. Black and white, plus lecture notes. (Produced by Camera Talks Ltd.)

***Environment: Air Pollution, Parts 1 and 2.** (1) Local, Continental and Natural. 41 frames. (2) Industrial pollution. 38 frames. Colour, plus lecture notes by Professor R. S. Scorer. (Produced by Diana Wyllie Ltd.) Sale price £3 each part.

***Chronic Bronchitis.** Section 1: Incidence and Causes. Section 2: Treatment and Management. Section 3: Public Health and the Prevention of Chronic Bronchitis. Colour. Lecture notes by Dr. J. L. Burn. (Produced by Diana Wyllie Ltd.) Sale price £2.

Small Heating Systems. Colour. (Produced by Union Head Visual Aids Ltd. for N.I.F.E.S.)

The Problem of Lung Cancer. Colour. (Produced by Camera Talks Ltd.)

Making the Modern Town (Smoke Abatement). A lecture by the Gas Council. Black and white. (Produced by Carlton Hill Film Studios.)

The Public Health Inspector. Colour. (Produced by Camera Talks Ltd.)

***The Air You Breathe.** Colour, plus lecture notes by Rear-Admiral P. G. Ltd.) Sale price £3 full frame, £2.50 Sharp. (Produced by Diana Wyllie half frame. (Full frame suitable for mounting into slides.)

Guide to Publications

This list of available books, reports and pamphlets on smoke prevention, atmospheric pollution and fuel usage is issued by the National Society for Clean Air as a reference guide for readers. It may also be used for ordering the publications which may be obtained either direct from the Society, or other bookseller.

Prices quoted are those current at the date of publication, and are subject to variation. Please add the appropriate amount from the following table to all orders, for postage and packing. 50p and below add 7p. Between 51p and 99p add 15p. £1 and over add 25p.

Information about older, out-of-print, and overseas publications may be obtained from the Society on request. Most of these are in the Society's library and can be consulted, or in some cases borrowed for short periods, by arrangement.

The Society operates a photocopy service, for out of print literature, etc. The price is 7p per page.

N.S.C.A. PUBLICATIONS

General

"Clean Air"
The quarterly journal of the Society. It contains articles, photographs, reports, news items, abstracts and other current information appertaining to air pollution and allied matters. Subscription rate £1.50 per year post free. Single copies 50p.

"Sulphur Dioxide"
An examination of sulphur dioxide as an air pollutant.
Price: 50p

"Air Pollution from Road Vehicles"
Problems and control of air pollution from diesel and petrol motor vehicles.
Price: 20p

"The Law Relating to Air Pollution"
A Summary of Legislation.
Price: 15p

"Fumifugium" or "The Smoake if London Dissipated"
John Evelyn's well-known tract (1661).
Price: 25p

"Towards Cleaner Air"
Details of a revised and up-dated edition will be published in " Clean Air ".

"Notes on the Background to Clean Air"
Very suitable for teachers, lecturers etc. complete with wall chart.
Price: 40p complete
25p Notes only
15p Wall chart

"Clean Air Act 1956"
A descriptive summary.
Price: 3p each, 10 for 25p

DES VOEUX MEMORIAL LECTURES

All at 5p each

"The Destructive Effects of Air Pollution on Materials"
Dr. A. Parker, 1955

"Meteorology and Air Pollution"
Sir Graham Sutton 1957

"Clean Air, Urban Amenity and the Growth of Towns"
Sir William Holford 1958

"Clean Air, Public Opinion and the Press"
Sir Linton Andrews

"Clean Air and Future Energy"
Dr. E. F. Schumacher 1967

CONFERENCE PROCEEDINGS

Details of earlier Conference Proceedings available on request.

Harrogate Conference, 1960. The Des Voeux Memorial Lecture — "Clean Air, Public Opinion and the Press," Address by Parliamentary Secretary, Ministry of Housing and Local Government, Series of progress reports on (1) Research and Investigation; (2) Domestic Heating; (3) Industrial Problems, Papers on Air Pollution from Road Vehicles, and an Inquiry into the Working of the Clean Air Act.
Price: £1.25

Brighton Conference, 1961. Opening Address by John C. George, Parliamentary Secretary, Ministry of Power, Presidential Address by Lord Cohen of Birkenhead. Reports on National Survey of Air Pollution. Furnace Operators Bill, Diesel Smoke; Papers on Industrial Aspects of the Clean Air Act, Whole House Heating, Smoke Control Areas and Transatlantic Discussion.
Price: 75p

Harrogate Conference, 1962. Five papers on air pollution in European Countries, a paper on the 1958 Alkali order Processes followed by a paper on Incineration and Waste Disposal.
Price: 25p (Preprints only)

Scarborough Conference, 1963. Address by The Rt. Hon. Lord Hastings, Papers on Smoke Control Areas and their Problems, The Importance of Public Relations, Air Pollution—The Human Problem, Pollution from Road Vehicles, Progress in a Heavy Chemical Industry, The Warwickshire Clean Air Council, Five papers on Research and Development and two papers on grit and dust emissions.
Out of print—photocopy service available.

Harrogate Conference, 1964. Opening Address by the Rt. Hon. Lord Sherfield. Presidential Address by Dr. Albert Parker. Smoke Control Area Reports from eight regions: two papers on Air Pollution and Town Planning, four papers on the future supply of smokeless Fuel; Des Voeux Memorial Lecture—"A Century of Achievement"; a paper on road vehicle pollution and discussion on the Sulphur Dioxide Report.
Price: £1.25

Eastbourne Conference, 1965. Opening Address by John Morris, M.P., Parliamentary Secretary, Ministry of Power, Presidential Address by Sir Alan Wilson, F.R.S. Three Reports on Successes with Smoke Control; two papers on solid fuel distribution and supply problem; air pollution and mortality; odour control; control of pollution from road vehicles; four papers on new horizons in domestic heating; two papers on industrial problems; two papers on unresolved problems in air pollution.
Price: £1.25

Blackpool Conference, 1967. Opening Address by Stephen Swingler, M.P., Ministry of State, Ministry of Transport, Presidential Address by Sir John Charrington. Report on Air Pollution from road vehicles: some specific air pollution problems; Clean Air and the North West Environment; two papers on effects of pollution on environment; Des Voeux Memorial lecture—"Clean Air and Future Energy"; a paper on the emission of grit and dust from furnaces; the cost of smoke control; a report on smokeless heating in new housing, industrial and municipal incineration of refuse; paper on new oxygen-fuel process in steelmaking.
Price: £1.00 (Preprints only)

Harrogate Conference, 1968. Part I: Four papers on Clean Air and Future Fuel Usage, three papers on Chimneys: Progress on Scheduled Works; three papers on the Measurement of Pollution; three papers on Vehicles; Paper on Practical Problems in the Approach to Smoke Control.
Out of print—photocopy service available.
Part II: Opening Address by Sir David Pitblado, K.C.B., C.V.O. Presidential Address and Reports of Discussions.
Price: 75p

Eastbourne Conference, 1969. Part I: Paper on Outstanding Problems in the Heavy Clay and Refractories Industry; The Pottery Industry's Contribution to Clean Air; Air Pollution Control in Oil Refining; Paper on Sulphur Oxides and Fuel Oils, Clean Air and Health in London; Dust Control in the Cement Industry and two papers on Iron and Steel—Progress Towards Clean Air. (A) Review of Progress. (B) Some Practical Problems.
Out of print—photocopy service available.
Part II: Opening Address by Lord Delacourt-Smith, Presidential Address, address on behalf of Baroness Serota and Reports of Discussions.
Price: £1.00

Southport Conference, 1970. Part I: Two papers on the Clean Air Act 1968; Paper on The Disposal of Refuse by Incineration; three papers on Conservation; three papers on Clean Air—the Balance Sheet; four papers on the Fuel Industry's Viewpoint; and two papers on Vehicle Pollution.
Price: £2.00
Part II: Opening Address by Eldon Griffiths M.P. Presidential Address, Reports of Discussions, and the paper Conservation in the North-West.
Price: £1.25

Folkestone Conference, 1971. Part I: A report by the Society's Technical Committee on Sulphur Dioxide, two papers on Odours and their Control, three papers on the Meteorological aspects of Air Pollution, three papers on Aircraft Pollution and a paper on the National Survey—Trends in Pollution.
Price: £2.50
Part II: Reports of the Discussions.
Price: £1.50

Scarborough Conference, 1972.
Part I:

1. Pollution Control—How far can we go?
   Prof. C. J. Stairmand
2. Metals in the Atmosphere
   R. A. Fish
3. The Scheduled Processes
   F. E. Ireland
4. The Chemical Industry and Air Pollution
   F. Whiteley
5. Odour Nuisances in Industry
   T. R. Jones

6. Odour Nuisances in Agriculture
   Dr. F. H. Peakin
7. Effects of Air Pollution on Plants
   Dr. L. H. P. Jones and D. W. Cowling

Part II: Opening Address by Lord Kearton, Presidential Address and reports of discussions.
Price: 50p per paper or £5.00 complete set together with Part II.

Technical Symposium, Manchester, 1972.

1. Industrial Waste—the Problem of Disposal
   N. Iliff
2. On site Incineration
   K. S. Dunn
3. Centralised Incineration
   W. A. Clennel and C. R. Mowle
4. Incineration of Rubber and Plastic Wastes
   G. Cheater
5. Incineration of Sewage Sludge
   G. Moodie
6. Integrated Environmental Design
   H. G. Mitchell
7. The Role of the Heating and Ventilating Engineer in Pollution Control
   F. M. H. Taylor
8. Dust Control in Factories
   P. Swift
9. Clean Rooms
   R. B. Williamson
10. A Practical Approach to the Statutory Control of Emissions
    C. R. Cresswell
11. Grit and Dust from Non-Combustive Processes
    C. D. Darley
12. High Efficiency Gas Cleaning
    K. Darby
13. Some Problems of Dry Processes for Removing SO_2 from Flue Gases
    J. Bettelheim and B. H. M. Billinge
14. Electrostatic Precipitators
    A. J. Moyes and M. Swift
15. Boiler Furnace Design Considerations for Dual Fuel Firing
    H. B. Weston
16. Modern Chimneys
    M. Beaumont
17. Progress in Automatic Control
    R. P. Braby

Part II: Report of the Discussions
Price: 40p per paper or £4.50 complete set together with Part II

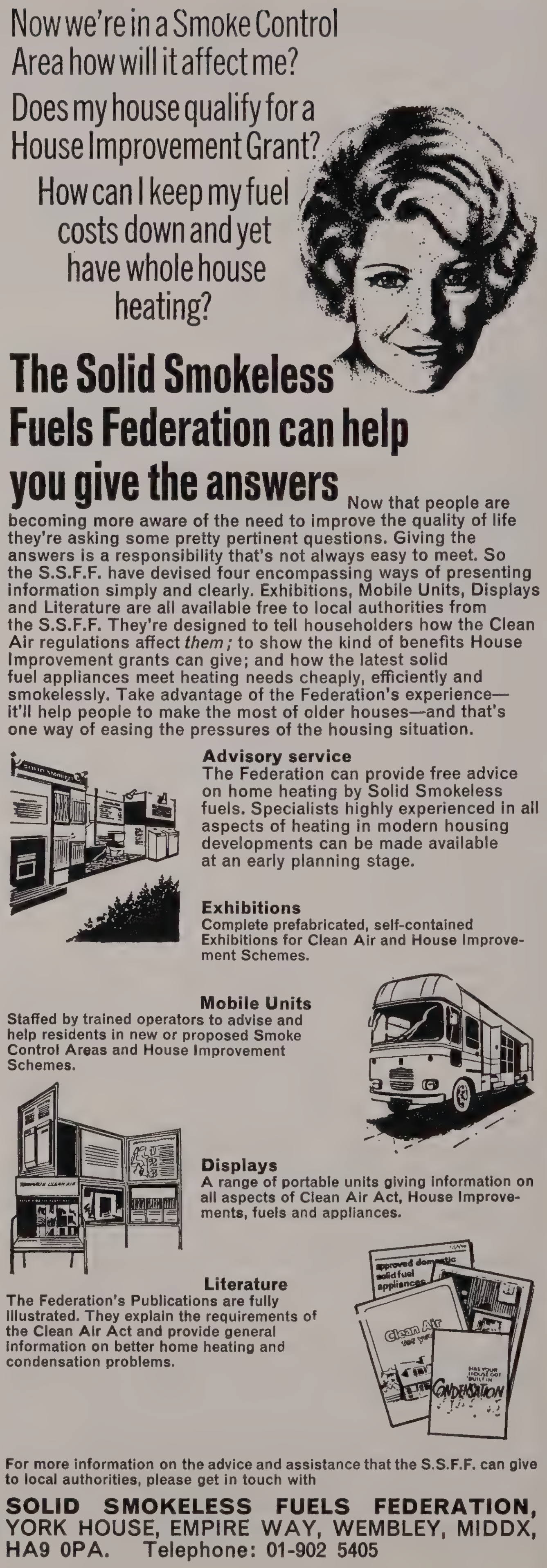
INTERNATIONAL CONGRESS LONDON 1966

The following papers are available at 12p each:

Sources and Distribution of Air Pollution Ascertained by Stationary Recording of Gaseous Components. W. Breuer and K. Winkler.

Study of the Effect of Air Pollution Upon Respiratory Diseases in London in the Winters of 1962-63 and 1963-64. S. J. Carne.

Collection of Dust from Refuse Incinerators in Electrostatic Precipitators Provided with Multicyclone After-Collectors. C. Cederholm.



Now we're in a Smoke Control Area how will it affect me?
Does my house qualify for a House Improvement Grant?
How can I keep my fuel costs down and yet have whole house heating?

The Solid Smokeless Fuels Federation can help you give the answers Now that people are becoming more aware of the need to improve the quality of life they're asking some pretty pertinent questions. Giving the answers is a responsibility that's not always easy to meet. So the S.S.F.F. have devised four encompassing ways of presenting information simply and clearly. Exhibitions, Mobile Units, Displays and Literature are all available free to local authorities from the S.S.F.F. They're designed to tell householders how the Clean Air regulations affect *them*; to show the kind of benefits House Improvement grants can give; and how the latest solid fuel appliances meet heating needs cheaply, efficiently and smokelessly. Take advantage of the Federation's experience—it'll help people to make the most of older houses—and that's one way of easing the pressures of the housing situation.

Advisory service
The Federation can provide free advice on home heating by Solid Smokeless fuels. Specialists highly experienced in all aspects of heating in modern housing developments can be made available at an early planning stage.

Exhibitions
Complete prefabricated, self-contained Exhibitions for Clean Air and House Improvement Schemes.

Mobile Units
Staffed by trained operators to advise and help residents in new or proposed Smoke Control Areas and House Improvement Schemes.

Displays
A range of portable units giving information on all aspects of Clean Air Act, House Improvements, fuels and appliances.

Literature
The Federation's Publications are fully illustrated. They explain the requirements of the Clean Air Act and provide general information on better home heating and condensation problems.

For more information on the advice and assistance that the S.S.F.F. can give to local authorities, please get in touch with

SOLID SMOKELESS FUELS FEDERATION,
YORK HOUSE, EMPIRE WAY, WEMBLEY, MIDDX,
HA9 0PA. Telephone: 01-902 5405

Atmospheric Pollution in Paris by Vehicle Exhaust Gases Measurement of Pollution Levels First Suggested Remedies. P. Chovin and R. Thiebault.

Alleviation of Air Pollution in the Coking Industry. R. L. Cooper and G. W. Lee.

Smoke and Sulphur Dioxide in Great Britain: Distribution and Changes. S. R. Craxford, Marjorie Clifton and Marie-Louise P. M. Weatherley.

Measurements of Concentrations of Particulate Pollutants in Ruhr. K. H. Friedrichs and A. Brockhaus.

The Working Party on Air Pollution—European Federation of Chemical Engineering. D. Gall.

The Concentration of Carbon Monoxide Measured at Different Altitudes Simultaneously in City Streets.
Sulphur Dioxide Concentrations Measured around a Modern Power Station.
E. W. F. Gillham, A. Martin and F. R. Barber.

Oil Burners for Domestic Application; Present Design and Future Developments. B. Gills and E. L. Howe.

Calculated Versus Continuously Measured SO_2 Concentrations with Regard to Minimum Stack Heights and Urban Renewal (urbanisme). K. Gräfe.

Tomorrow's Town Transport—The Advantages of Electric Traction. A. N. Irens.

Method for the Abatement of Air Pollution Caused by Cement Plants. W. Kohler.

Sub-Minute Continuous Nitrogen Dioxide Analysis. E. L. Kothny and P. K. Mueller.

Determinating Source Reduction Needed to Meet Air Quality Standards. Ralph I. Larsen.

Progress in Air Pollution Controls in South Africa. C. E. Latsky and E. C. Halliday.

Collection of Dust from Oil-Fired Boilers in Multi-Cyclones and Electrostatic Precipitators. S. Maartman.

Tree Belts as a Protection against the Harmattan in Nigeria. B. A. Molski.

Towards Cleaner Diesel Engine Exhausts. R. E. Pegg and A. W. Ramsden.

The Role of Gas in the Reduction of Air Pollution. F. F. Robb.

Air Pollution Monitoring in Canada. G. R. Ross and H. J. Wilson.

International Dust and Fume Collection Problems. G. G. Schneider.

Pioneering Experience with High Stacks on the Ovec and American Electric Power Systems. P. Sporn and T. T. Frankenburg.

Studies on Automatic Recording Apparatus for Measurements of Oxidants in Air. S. Suzuki.

Reprints

1. **Some factors concerning Diesel Engine Exhaust Fumes.** J. K. Lock, 1960.
2. **Methods of Removing Smoke from Road Vehicles.** L. E. Reed and S. C. Wallin, 1960.
3. **Sampling for 3:4 Benzpyrene in Flue Gas from Plant fired by Petroleum Fuels.** E. L. Howe, 1960.
4. **Trends in the Pollution of the Air of Great Britain 1952-59.** J. Carroll, S. R. Craxford, H. E. Newall, P. M. Weatherley, 1960.
5. **Accuracy and Reliability of Instruments in Common Use for Measurement of Air Pollution.** S. R. Craxford, E. T. Wilkins, D. W. Slimming, 1960.
6. **The National Survey of Air Pollution.** Marjorie Clifton, S. R. Craxford, Mrs. P. M. Weatherley, 1961.
7. **Mitigation of Air Pollution at Coking Plants.** R. L. Cooper and J. P. Graham, 1962.
8. **Incineration and Waste Disposal.** S. Cayton, 1962.
9. **Power Stations and Clean Air.** G. N. Stone and A. J. Clarke, 1963.
10. **Odour Control by Catalytic Combustion.** E. Betz, 1965.
11. **Corrosion by Air Pollution: A Review.** J. R. Goss, 1967.
12. **Industrial and Municipal Incineration of Refuse.** E. J. Ostle, 1967.
13. **Some Minerological Aspects of Air Pollution Damage to Limestone.** K. J. Henley, 1967.
14. **The National Survey of Smoke and Sulphur Dioxide—The First Ten Years.** S. R. Craxford, Mrs. P. M. Weatherley, Mrs. B. D. Gooriah, 1971.

Price: 10p per reprint.

POSTERS

1. Clean Air is Your Affair
2. Prevent Air Pollution—Britain's Biggest Headache
3. Lungs, Plants, Animals, Buildings and Your Pocket are being attacked by Air Pollution
4. Couldn't You Do With Some Clean Air ?
5. Road Vehicle Pollution

Price: 12p per poster (double crown)
£10 per 100 copies (can be mixed)

LEAFLETS

1. Clean Air Begins at Home
2. The Air You Breathe
3. Prevent Air Pollution—Britain's Biggest Headache

Price: £1.25 per 100
£10 per 1000
Quotations given for larger quantities

A SELECTION OF BOOKS ETC. WHICH ARE AVAILABLE FROM THE SOCIETY

Books not listed may be ordered through the Society.

Air Pollution. Ed. Arthur C. Stern 1968. **Vol. 1: Air Pollution and its effects** pp. 850 £15.17. **Vol. 2: Analysis Monitoring and Surveying** £16.33. **Vol. 3: Sources of Air Pollution and their Control** £22.17.

Smoke Inspector's Handbook by A. Coe and I. M. Coe, 2 volumes. £7.50

Atmospheric Pollution: Its Origin and Prevention. Meetham, A. R., in collab. with Bottom, D. W. and Cayton, S. 3rd revised edition, pp. 301. Pergamon Press, Oxford. £3.50

Gas Purification Processes. Ed. by G. Nonhebel, pp. 894. George Newnes, London. £7.00

Air Pollution. Smith, A. R. Monograph No. 22, Society of Chemical Industry, 14 Belgrave Square, London, S.W.1. 1966. £3.50

Clean Air—Law and Practice, Third Edition. Garner, J. P. and Crow, R. K., 1969, pp. 506. Shaw & Sons Ltd. £5.25

The Environmental Revolution. Nicholson M., Hodder & Stoughton. £4.20

Air Pollution Control. Ed. Werner Strauss.
Part I £9.50 Part II £7.60

Ringlemann Smoke Chart (with instructional leaflet). Chart for measuring smoke density. 7p each: 10 for 60p

'Power's' Microringelmann. Direct facsimile reduction of the standard Ringlemann Chart (McGraw-Hill).
25p each: 10 for £2

H.M.S.O. PUBLICATIONS

Acts and Memoranda

Clean Air Act, 1956. The Statute governing smoke, containing sections on dark smoke, smoke from furnaces, grit and dust from furnaces, smoke control areas, smoke nuisances, special cases, clean air council and miscellaneous provisions. (H.M.S.O., 1956) 4 & 5 Eliz. 2 Ch. 52. 10p

Clean Air Act, 1956. Memorandum on Smoke Control Areas. (H.M.S.O., 1956) 6p

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions. (H.M.S.O., 1956) 3p

Amendment to Model Byelaws. Series IV Buildings (1953) Edition. (H.M.S.O., 1956) 1p

Thermal Insulation (Industrial Buildings) Act, 1957. (5 & 6 Eliz. 2 Ch. 40). (H.M.S.O., 1957) 3p

Clean Air Act, 1956. Memorandum on Industrial Provisions. (H.M.S.O., 1958) 5p

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions (Scotland). (H.M.S.O., 1959) 5p

Housing Act, 1964. (H.M.S.O.) 43p

Clean Air Act (Northern Ireland), 1964. Memorandum on Smoke Control Areas (H.M.S.O., 1965) 11p

West Riding County Council (General Powers) Act, 1964. (H.M.S.O.) 15p

Clean Air Act (Northern Ireland), 1964, Belfast. (H.M.S.O.) 17p

Chimney Heights. Second edition of the 1956 Clean Air Act Memorandum (H.M.S.O., 1967) 10p

Chimney Height Charts. The Appendices to the Clean Air Act publication "Chimney Heights" printed on permatrace. (H.M.S.O., 1967) 70p

Report of the Working Party on Grit and Dust Emission. (M.H.L.G. Memorandum). (H.M.S.O.) 15p

Clean Air Act, 1968. (H.M.S.O., 1968). Eliz. 2 Ch. 62. 10p

Statutory Instruments

The Clean Air Act 1956 (Appointed Day) Order 1956
(S.I. 1956, No. 2022) — 1p

The Smoke Control Areas (Authorised Fuels) Regulations 1956 (S.I. 1956, No. 2023) — 1p

Smoke Control Areas (Exempted Fireplaces) Order, 1957.
(S.I. 1957, No. 541) — 1p

Clean Air Council Order, 1957.
(S.I. 1957, No. 766)

The Clean Air Act 1956 (Appointed Day) Order 1958
(S.I. 1958, No. 167) — 1p

The Alkali etc. Works Order 1958
(S.I. 1958, No. 497) — 1p

The Dark Smoke (Permitted Periods) Regulations 1958
(S.I. 1958, No. 498) — 1p

The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (S.I. 1958, No. 878) — 1p

The Clean Air Act 1956 (Appointed Day No. 2) (Scotland) Order 1958 (S.I. 1958, No. 1931 (C.11) (S.104)) — 1p

The Alkali etc. Works (Scotland) Order 1958
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The Clean Air Act 1968 (Commencement No. 3) 1969 (S.I. 1969, No. 995 (c.24))

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The Smoke Control Areas (Authorised Fuels) Regulations 1969 (S.I. 1969, No. 1798) — 2p

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The Smoke Control Areas (Exempted Fireplaces) (No. 2) Order 1972 (S.I. 1972, No. 955)

The Gas Safety Regulations 1972 (S.I. 1972, No. 1178)

CIRCULARS

No. 27/57	Clean Air Act 1956 Smoke Control Areas (Exempted Fireplaces) Order 1957
No. 6/58	Clean Air Act 1956 Date of operation of remaining provisions; byelaws under section 24; miners' concessionary coal; approval of new furnaces.
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MISCELLANEOUS

Committee on Air Pollution.
The Interim Report of the Beaver Committee appointed in July, 1953, to examine the nature, causes and effects of air pollution and the efficiency of present preventive measures to consider what further preventive measures are practicable; and to make recommendations (Cmnd. 9011).
(H.M.S.O., 1953) 19p

Committee on Air Pollution.
The Final Report of the Beaver Committee. (Cmnd. 9322).
(H.M.S.O., 1954) 23p

The Efficient Use of Fuel.
(H.M.S.O., for Ministry of Power) £1.75

The Investigation of Atmospheric Pollution.
Reports by the Fuel Research or Warren Spring Laboratory, Ministry of Technology co-ordinating local observations of atmospheric pollution 32nd Report (1958-1966) 52p
107th Annual Report on Alkali etc. Works for 1970 65p

The Protection of the Environment. The Fight Against Pollution. May 1970 15p

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Services Provided by the National Society for Clean Air

Information and Advice

General advice, assistance and information on matters relating to atmospheric pollution and its prevention is available free of charge to Members. If the information required is not immediately available to the Society's Information Department, the Society is prepared, on behalf of a Member, to obtain it from one of the specialised Information Bureaux.

Library

The Society's Library is available for the use of all Members, both for consultation in the Society's offices or for loan purposes. In most cases students or research workers can also use the facilities provided. It possesses an extensive collection of both British and foreign books, reports and pamphlets on air pollution and related subjects. In some cases the Society is the only organization in the United Kingdom receiving the publication. The Society is linked with various specialist and technical libraries, and when a publication relating to some special aspect of air pollution is not in the library, the Society can often borrow it through other sources. Applications should be made initially to the Librarian.

The library also possesses a classified collection of photographs (mainly black and white, some coloured) depicting domestic and industrial smoke; damage to buildings, stonework and plants and other allied subjects. These are suitable for reproduction and/or display purposes. Prints may be inspected at the Society's offices, or a selection will be sent by post if details of requirements are given. The copyright of the photograph is retained by the photographer and where reproduction fees are chargeable, the inquirer should communicate with the photographer. The Library does not hold any negatives.

A small collection of slides and film-strips are available for loan but two or three weeks' advance notice should be given for these. A comprehensive list of films available from other sources is given elsewhere in this Year Book.

Lectures

The Society will be pleased to help members and others in any part of the country to arrange lectures and talks of all kinds on atmospheric pollution and related subjects.

Exhibitions

The Society is prepared to consider participating in suitable exhibitions, and has a mobile modular exhibition stand available for this purpose.

Publicity Advisory Service

The Society's Publicity Advisory Service is available to help Local Authorities and Corporate Members with their Clean Air Publicity, especially when Smoke Control Orders are pending.

The Service advises members on display material, its arrangement for exhibitions, stands, etc., and supplies information on other publicity activities such as public meetings, local press features and correspondence, educational work in schools, women's organisations, etc.

No charge is made for this service to members.

Exhibition Display Material

The Society has several exhibition units available for loan by local authorities and corporate members. These units are adaptable for displays ranging from 20 sq. ft. to 300 sq. ft. of floor space, and are complete with their own graphics.

Demand for these units is heavy particularly in the spring and autumn, and it is essential that inquiries are made as far in advance as possible.

No charge is made to members for the loan of these units except the cost of carriage both ways. A hire charge of £10 is made to non-members together with carriage both ways.

Posters and Leaflets

Details and prices of suitable posters and leaflets can be found elsewhere in the Year Book.

The Clean Air Case

A Synopsis for the Guidance of Speakers, Writers, Teachers, etc.

1. Historical Background. Growth of the air pollution problem and efforts to abate it, from 852 to the present day. (*See History table.*)

2. Nature, Sources and Causes.
Smoke: Due to incomplete combustion; consists of fine carbonaceous particles and tarry droplets. (For quantities produced, *see Table.*)

Gases: Sulphur dioxide the most harmful, especially when in association with smoke particles. Also carbon monoxide, and noxious gases and fumes from chemical processes. See the Society's Report on *Sulphur Dioxide as an Air Pollutant*.

Grit and dust: Mainly from industrial sources, e.g., pulverized coal and highdraught furnaces.

3. Extent and Behaviour of Pollution. Measurement of floating and deposited impurities, sulphur dioxide, and of light values. The Investigation under the Warren Spring Laboratory (*q.v.*).

4. Fog. Natural and smoke fogs, their formation and characteristics. The London, 1952, 1962, and other lethal smogs.

5. Effects. *Health*: Effects on respiratory system. Effects due to obstruction of natural light. Possible relationship with lung cancer. Psychological and social consequences of life in smoke-ridden environment. Effects of smog are the result of infrequent high concentration of pollution, whereas the insidious action of "normal" pollution takes place continuously.

Plant Life: Principal factors injurious to vegetation are: loss of sunlight, blocking of stomata by deposits, direct attack by chemicals, acidification of soil. Indirect effect on grazing animals through deterioration of herbage, or of poisoning in the case of fluoride pollution.

Materials: Corrosion or erosion of metals, stone, fabrics, leather, etc.

Visibility: Loss of visibility due to smoke haze and smog affecting air and surface transport.

Costs: *See table.*

6. Prevention. *Industrial Smoke*: Calls for correct equipment, maintenance and operation of plant. Value of mechanical stoking. Uses of oil, gas, electricity and smokeless solid fuel. Importance of training and certification of stokers. Instrumentation, smoke alarms, etc. Need for all-round fuel efficiency. *Dust and grit*: Use of arrestors of appropriate types: cyclones, wet washing, electrostatic precipitators. *Sulphur*: removal by coal washing, flue gas-washing and other possible means. Importance of high chimneys and emission velocity.

Domestic: By use of smokeless fuels—gas, electricity, oil or solid. Need for efficient appliances. Central and district heating, whole-house warming, off-peak electrical methods, etc. Smoke control areas, purpose and national programme.

Railways and Roads: Use of diesels and electricity for the former. Need for efficient combustion and good maintenance in road vehicles. (*See also N.S.C.A. booklet "Air Pollution from Road Vehicles"*, 20*p.*)

7. Policy, Law, etc. The present law—Clean Air Acts, 1956 and 1968, Public Health Act, 1936, local Acts, Road Traffic Act, 1930, Alkali, etc., Works Regulation Act, 1906, and Orders, etc. The Beaver Report and its proposals. Responsibilities of local authorities and central Government. Smokeless zones and smoke control areas. Work of the Warren Spring Laboratory. Alkali Inspectorate and other organizations. Educational and publicity work of the National Society for Clean Air.

(*See also the N.S.C.A. booklet "Notes on the background to Clean Air"*, 25*p.*)

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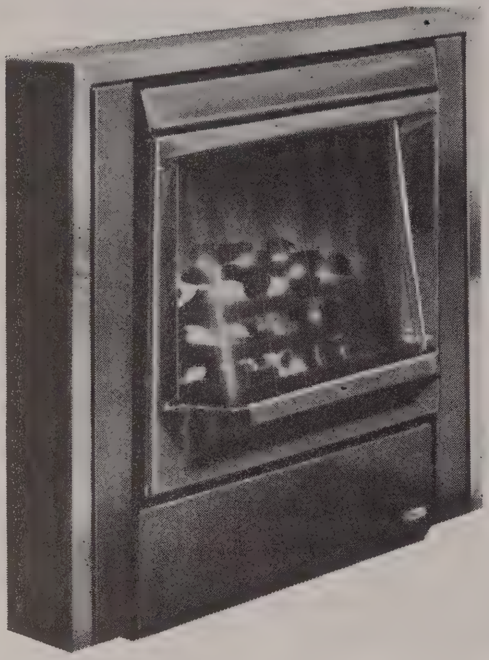

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Environmental Resources Ltd.
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tel: 01-629 4912

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The International Union of Air Pollution Prevention Associations

The International Union was originally established in 1965 with six founder members—United States of America, Argentina, France, Great Britain, Japan and West Germany. The Union consists of non-governmental organisations only and its primary functions are to promote collaboration and the exchange of information on air pollution and environmental problems and to organise, through its member associations, international congresses.

The first congress of the Union was held in London in 1966; the second International Clean Air Congress was held in Washington D.C., U.S.A. from 6th December to 11th December 1970 and the third International Congress will be held in Dusseldorf, West Germany in the autumn of 1973.

The President of the I.U.A.P.P.A., the third one to hold office, is Herr Professor Dr. H. Schackmann of V.D.I.—Kommission Reinhaltung der Luft, of West Germany; the Secretary of the International Union is Herr N. Endell.

Since its inception in 1965 the I.U.A.P.P.A. has now grown to twelve full corporate members and six affiliate members.

Corporate Members:

Asociacion Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires, Argentina.

Clean Air Society of Australia and New Zealand, P.O. Box 59, Bankstown, 2200, Sydney, New South Wales, Australia.

Associação Brasileira de Prevençao à Poluicão do Ar, Departamento de Saúde Ambiental, Faculdade de Saúde Publica, Caixa Postal 8099, Sáo Paulo, Brazil.

Association Pour La Prévention de la Pollution Atmosphérique, 62 Rue de Courcelles, Paris 8e, France.

VDI-Kommission Reinhaltung der Luft, Graf-Recke Strasse 84, Postfach 1139, 4 Dusseldorf 1, Federal Republic of Germany.

National Society for Clean Air, 134-137 North Street, Brighton BN1 1RG, Great Britain.

National Association for Clean Air, P.O. Box 5777, Johannesburg, Transvaal, South Africa.

Industrial Public Nuisance Control Association, Kudan-Building, 2-2-5, Kudan-minami, Chiyoda-Ku, Tokyo, Japan.

Asociacion Mexicana Contra la Contaminacion del Agua y del Aire, A.C., Toree de Ciencias 50 Piso, Ciudad Universitaria, México 20, D.F., México.

SICOM, Stichting International Contactorgaan Milieubescherming, Postbus 214, Delft, The Netherlands.

Schweiz. Vereinigung für Gesundheitstechnik (SVG), Postfach 305, 8035 Zurich, Switzerland.

Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pa., 15213, U.S.A.

Affiliate Members:

Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.), Den Norske Ingeniørforening, Kronprinsensgate 17, Oslo 2, Norway.

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire, Jr, Moquegua 336 - Of. 206, Lima, Peru.

Asociacion Uruguaya Contra la Contaminacion del Aires, Calle Colonia 1422, P.6, Ap. 601, Montevideo, Uruguay.

Yugoslav Commity for Chemical Engineering, Section of Air Pollution Prevention, Sarajevo, Omladinsko setaliste bb, Yugoslavia.

Associazione Termotecnica Italiana, Piazzale R. Morandi, 2 20121 Milano, Italy.

The Public Council for the Prevention of Noise and Air Pollution in Israel, P.O.B. 23047, Tel-Aviv, Israel.

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Building Research Establishment, Building Research Station, Garston, Watford WD2 7JR. (Garston (Herts) 74040). Fire Research Station, Borehamwood, Herts WD6 BL. (01-953 6177). Princes Risborough Laboratory, Princes Risborough, Aylesbury, Bucks. (Princes Risborough 3101).

Civic Trust, 17 Carlton House Terrace, London SW1Y 5AW (01-930 0914).

Housing Centre Trust, 13 Suffolk Street, London S.W.1. (01-930 2881).

Incorporated Association of Architects and Surveyors, 29 Belgrave Square, London S.W.1. (01-235 3755/7).

Institution of Civil Engineers, Great George Street, London SW1P 3AA (01-839 3611).

Institute of Housing Managers, Victoria House, Southampton Row, London WC1B 4EB. (01-242 3267/8).

Institution of Municipal Engineers, 25 Eccleston Square, London SW1V 1NX. (01-834 5082/3).

International Institute for Conservation of Historic & Artistic Works, 608 Grand Buildings, Trafalgar Square, London WC2N 5HN. (01-839 5975).

National Housing and Town Planning Council Incorporated, 11 Green Street, London W1Y 4ES. (01-629 7107/8).

Royal Institute of British Architects, 66 Portland Place, London W1N 4AD. (01-580 5533).

Royal Society of Arts, 6-8 John Adam Street, London WC2N 6EZ. (01-839 2366).

Royal Town Planning Institute, 26 Portland Place, London W1N 4BE. (01-636 9107/8/9).

Society for the Protection of Ancient Buildings, 55 Great Ormond Street, London WC1N 3JA. (01-405 2646).

Structural Insulation Association, Audley House, 9 Margaret Street, London W1N 7LF. (01-637 7031).

Town and Country Planning Association, 17 Carlton House Terrace, London SW1Y 5AS. (01-930 8903).

CLEAN AIR

HM Alkali and Clean Air Inspectorate:
Chief Inspector, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London, SW1H 9JW (01-930 4300, ext. 76).
Deputy Chief Inspectors, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London, SW1H 9JW (01-930 4300, ext. 54, 61 and 541).
Chief Inspector for Northern Ireland, M. D. Hinchliff, Government of Northern Ireland, Ministry of Development, Alkali and Radiochemical Inspectorate, Stormont, Belfast, BT4 3SS (Belfast 42751).
Chief Inspector for Scotland, HM Industrial Pollution Inspectorate for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY (031-226 5208).

Clean Air Council, Department of the Environment, Whitehall, London S.W.1. (01-930 4300 ext. 345).

Clean Air Council for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY. (031-226 5208).

Derbyshire Clean Air Joint Consultative Committee. Town Clerk's Office, Town Hall, Chesterfield (0246-77232).

Institution of Chemical Engineers, 16 Belgrave Square, London SW1X 8PT. (01-235 3637).

Institute of Petroleum, Atmospheric Pollution Committee, 61 New Cavendish Street, London W.1. (01-636 1004).

Manchester and District Regional Clean Air Council, Town Hall, Manchester M60 2JS (061-236 3377 ext. 2592).

Midlands Joint Advisory Council for Clean Air & Noise Control, Public Health Department, Ednam House, St. James's Road, Dudley, Worcs. (Dudley 55433 ext. 174).

National Society for Clean Air
Central Offices: 134-136 North Street, Brighton, BN1 1RG (Brighton 26313).
Scottish Division: Town Clerk's Office, 78 Cochrane Street, Glasgow (041-221 9600, ext. 2538).
Northern Ireland Division: Belfast Corporation Health Department, 16 College Street, Belfast, BT1 6BX (Belfast 41771).
North West Division: Health Centre, Crescent, Salford, Lancs. (061-736 5891).
North East Division: Civic Centre, Barras Bridge, Newcastle upon Tyne (28520).
Yorkshire Division: Health Dept., 12 Market Building, Vicar Lane, Leeds 1 (30211, ext. 29).
East Midlands Division: Public Health Dept., County Borough of Derby, Castlefields House, Main Centre, Derby DE1 2FL (Derby 31111).
West Midlands Division: Public Health Dept., Trafalgar House, Paradise Street, Birmingham B1 2BQ (021-235 3759).
South East Division: Public Health Dept., 8 Easton Street, High Wycombe (High Wycombe 26100).
South West Division: Public Health Inspector's Office, Union House, Union Street, Bristol BS1 (0272 26241).
South Wales and Monmouthshire: 9 Lodge Drive, Baglan, Port Talbot (5231).

Royal Institute of Chemistry, 30 Russell Square, London WC1B 5DT (01-580 3482).

Sheffield and District Clean Air Committee, Town Hall, Sheffield (0742 26444).

Tees-side Clean Air Committee, Town Clerk's Office, Municipal Buildings, Middlesbrough, Teesside. (0642 45984).

Warwickshire Clean Air Council, The Council House, Southbank Road, Kenilworth, Warwickshire (Kenilworth 58131).

West Bromwich Clean Air Council, C. R. Cresswell, West Bromwich Corporation, P.O. Box 40, Town Hall, Lombard Street West, West Bromwich.

West Lancashire and Cheshire Regional Smoke Abatement Committee, c/o Health Department, Hatton Garden, Liverpool L3 2AW, or 6 Brougham Terrace, Liverpool L6 1AE (051-263 5511, ext. 1).

West Riding Advisory Council for Clean Air & Noise Control, The, Public Health Department, Provincial Insurance House, Bond Court, Leeds LS1 2TZ. (0532-30661).

FUEL AND ENERGY

British Coke Research Association, Chesterfield, Derbys. (Chesterfield 76821).

British Gas Corporation, The, 59 Bryanston Street, Marble Arch, London W1A 2AZ. (01-723 7030).

Central Electricity Generating Board, Sudbury House, 15 Newgate Street, London E.C.1. (01-248 1202).

Coal Utilisation Council, 19 Rochester Row, London SW1P 1LD (01-834 2339).

Coke Oven Managers' Association, Waveney House, Adwick Road, Mexborough, Yorks S64 OBS.

College of Fuel Technology, 90 Talbot Road, Highgate, London N6 4RB (01-340 6972).

Combustion Engineers Association, *Beaufort Chambers, 240B High Street, Slough, Bucks. (Slough 33211).

Domestic Solid Fuel Appliances Approval Scheme, 19 Rochester Row, London SW1P 1LD (01-834 2339).

Electrical Association for Women, 25 Foubert's Place, London W1V 2AL (01-437 5212/3).

Electrical Research Association, Cleeve Road, Leatherhead, Surrey (Leatherhead 74151). Telex 264045.

Electricity Council, 30 Millbank, London SW1P 4RD (01-834 2333).

Esso Petroleum Co. Ltd., Victoria Street, London S.W.1. (01-834 6677).

Institute of Fuel, 18 Devonshire Street, London W1N 2AU (01-580 7124).

Institution of Electrical Engineers, Savoy Place, London WC2R OBL (01-240 1871).

Institution of Gas Engineers, 17 Grosvenor Crescent, London SW1X 7ES (01-245 9811).

Institution of Heating and Ventilating Engineers, 49 Cadogan Square, London S.W.1 (01-235 7671/2/3).

Low Temperature Coal Distillers' Association of Great Britain Ltd., *P.O. Box No. 21, Chesterfield, Derbys (0246 822281/9).

National Coal Board, Hobart House, Grosvenor Place, London S.W.1 (01-235 2020).

National Industrial Fuel Efficiency Service Ltd.
Registered office:
54/58 Bartholomew Close, London, EC1A 7HD (01-606 5906).
Offices:
84 High Street, Buntingford, Herts. (0763 71154).
88 Cathedral Road, Cardiff, CF1 9LN (0222 33825).
Wellington House, 190, Derby Road, Nottingham, NG7 1NR (0602 44753).
26 Calthorpe Road, Edgbaston, Birmingham, B15 1RP (021-454 4471).
N.I.F.E.S. House, Sinderland Road, Broadheath, Altrincham, Cheshire, WA14 5HQ (061-928 5791).
St. Paul's House, 20/22 St. Paul's Street, Leeds, LS1 2QE (0532 20046).
26 Portland Terrace, Jesmond, Newcastle-upon-Tyne, NE2 1QJ (0632 813776).
6 Park Terrace, Glasgow, G3 6BY (041-332 2453).
49 Meadowside, Dundee, DD1 1EQ (0382 22179).

Shell-Mex & B.P. Ltd., *Shell-Mex House, Strand, London W.C.2 (01-836 1234).

Society of British Gas Industries, 17 Grosvenor Crescent, London S.W.1 (01-235 7169).

Solid Smokeless Fuels Federation, York House, Empire Way, Wembley, Middlesex (01-902 5405).

Women's Advisory Council on Solid Fuel, 19 Rochester Row, London SW1P 1LA (01-834 4251).

Women's Gas Federation and Young Homemakers, Gaywood House, 29 Great Peter Street, London SW1P 3LW (01-222 3677/0).

GENERAL

City and Guilds of London Institute, 76 Portland Place, London W1N 4AA (01-580 3050).

National Council of Women of Great Britain, The, 36 Lower Sloane Street, London SW1W 8BP (01-730 0619).

National Council of Social Service, The, 26 Bedford Square, London WC1B 3HU (01-636 4066).

Royal Institution of Great Britain, 21 Albemarle Street, London W1X 4BS (01-493 0669 and 5716).

GENERAL ENVIRONMENT AND CONSERVATION BODIES

Committee for Environmental Conservation, 4 Hobart Place, London SW1W OHY (01-235 9481).

Conservation Society, 34 Bridge Street, Walton-on-Thames, Surrey (Walton-on-Thames 41793).

Council for the Protection of Rural England, 4 Hobart Place, London SW1W OHY (01-235 9481).

***Council for the Protection of Rural Wales** (Cymdeithas Diogelu Harddwych Cymru), Meifod, Montgomeryshire (Meifod 383).

ERA Environmental Sciences Research, High Street, Cranfield. Bedford (Cranfield 771).

National Trust for Places of Historical Interest or Natural Beauty, 42 Queen Anne's Gate, London S.W.1 (01-930 0211).

Royal Commission on Environmental Pollution, Church House (3rd Floor), Great Smith Street, London SW1P 3BL (01-930 3324, ext. 2).

GOVERNMENT AND LOCAL BODIES

Association of County Councils in Scotland, 3 Forres Street, Edinburgh (031-225 1626/7).

Association of Municipal Corporations, 36 Old Queen Street, Westminster, London SW1H 9JE (01-930 9861).

County Boroughs Association, Guildhall, Kingston upon Hull (Kingston upon Hull 36880).

County Councils Association, Eaton House, 66A Eaton Square, London SW1W 9BH (01-235 5173).

Department of the Environment, 2 Marsham Street, London S.W.1 (01-212 3434).
Clean Air Division: Queen Anne's Chambers, Tothill Street, London S.W.1 (01-930 4300).
(Also see Alkali and Clean Air Inspectorate).

Department of Trade and Industry, Research Division, Abell House, John Islip Street, London SW1P 4LN (01-834 4422).

Her Majesty's Stationery Office, Atlantic House, Holborn Viaduct, London EC1P 1BN (headquarters) (01-248 9876), and at Sovereign House, St. Georges Street, Norwich, NOR 76A (Norwich 22211).

London Boroughs Association, Westminster City Hall, Victoria Street, London SW1E 6QW (01-828 8070).

Parliamentary and Scientific Committee, 14 Buckingham Palace Road, London SW1W 0QP (01-834 2608).

Rural District Council's Association, 25 Buckingham Gate, London SW1E 6LE (01-828 7425/8).

Scottish Counties of Cities Association, *City Chambers, Edinburgh (031-225 2424).

Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY (031-226 5208, ext. 38).

Standing Conference of Co-operating Bodies, Warren Spring Laboratory (Department of Trade and Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

Warren Spring Laboratory (Department of Trade and Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

U.K. Atomic Energy Research Establishment, Harwell, Didcot, Berks. (Abington 4141).

Urban District Council's Association, Palace Chambers, Bridge Street, London S.W.1 (01-930 4868).

HEALTH

Association of Public Health Inspectors, 19 Grosvenor Place, London S.W.1 (01-235 5158/9).

British Medical Association, B.M.A. House, Tavistock Square, London WC1H 9JP (01-387 4499).

Department of Health and Social Security, Alexander Fleming House, Elephant and Castle, London SE1 6B7 (01-407 5522).

Health Education Council, Middlesex House, Ealing Road, Wembley, Middlesex, HA0 1HH (01-998 2731).

Institute of Hospital Engineering, 20 Landport Terrace, Southsea, Hampshire PO1 2RG (0705 23186).

Institution of Public Health Engineers, 32 Eccleston Square, London SW1V 1PB (01-834 3017).

Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical College, Charterhouse Square, London E.C.1 (01-252 1537).

Royal Institute of Public Health and *Hygiene, 28 Portland Place, London W1N 4DE (01-580 2731/2).

Royal Sanitary Association of Scotland, The, 113 West Regent Street, Glasgow G2 2RY (041-248 7955).

Royal Society of Health, 13 Grosvenor Place, London SW1X 7EN (01-235 9961/5).

Society of Medical Officers of Health, Tavistock House South, Tavistock Square, London WC1H 9LD (01-387 3923).

INDUSTRY, INSTRUMENTS AND STANDARDS

***British Industrial Measuring and Control Apparatus Manufacturers' Association,** 23/24 Margaret Street, London W1N 7LB (01-580 9336).

British Oil and Gas Firing Equipment Manufacturers' Association, The Fernery, Market Place, Midhurst, Sussex (Midhurst 2782).

British Standards Institution, British Standards House, 2 Park Street, London W1A 2BS (01-629 9000).

Confederation of British Industry, 21 Tothill Street, London SW1H 9LP (01-930 6711).

Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ (01-930 7476).

Institution of Plant Engineers, 138 Buckingham Palace Road, London SW1W 9SG (01-730 0469).

Scientific Instrument Manufacturers' Association of Great Britain, 20 Peel Street, London W.8 (01-727 2614).

Sira Institute, South Hill, Chislehurst, Kent (01-467 2636).

IRON AND STEEL

BISRA — The Corporate Laboratories, British Steel Corporation, 24 Buckingham Gate, London S.W.1 (01-828 7931).

British Cast Iron Research Association, Alvechurch, Birmingham B48 7QB (Redditch 66414).

British Independent Steel Producers Association, 5 Cromwell Road, London SW7 2HX (01-581 0231).

British Steel Corporation, P.O. Box 403, 33 Grosvenor Place, London S.W.1 (01-235 1212).

Council of Ironfoundry Associations, 14 Pall Mall, London S.W.1 (01-930 7171).

Joint Iron Council, 14 Pall Mall, London S.W.1 (01-930 7171).

Institution of Corrosion Technology, The, 14 Belgrave Square, London SW1X 8PS (01-245 9189).

Steel Castings Research and Trade Association, East Bank Road, Sheffield S2 3PT (0742 28647).

METEOROLOGY

Meteorological Office, London Road, Bracknell, Berkshire (0344 20242).

Meteorological Office, Weather Centres
Forecasts, London: 01-836 4311
Glasgow: 041-248 3451
Manchester: 061-832 6701
Newcastle: 0632 26453
Southampton: 0703 28844
Nottingham (Watnall): 060-75 3311.

Royal Meteorological Society, Cromwell House, High Street, Bracknell, Berks. (Bracknell 22957).

TRANSPORT

***British Internal Combustion Engine Research Institute Ltd.,** 111/112 Buckingham Avenue, Slough, Bucks SL1 4BH (Slough 27371).

Institute of Road Transport Engineers, The, 1 Cromwell Place, Kensington, London SW7 2JF (01-589 3744).

Motor Industry Research Association, The, Watling Street, Nuneaton, Warwickshire (Nuneaton 68541).

OVERSEAS

Argentine

*Asociación Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires.

Australia

Clean Air Society of Australia and New Zealand, P.O. Box 163, Lidcombe, N.S.W. 2141.

Air Pollution Control Branch, N.S.W. Department of Health, P.O. Box 163, Lidcombe, N.S.W. 2141.

Department of Public Health, Box 65, Rundle Street, Adelaide, S.A. 5000.

Division of Air Pollution Control, Department of Health, 484 Adelaide St., Brisbane, Qld. 4000.

Environmental Control, Department of Labour and Industry, 81 Brisbane St., Hobart, Tas. 7000.

Environmental Protection Authority, 232 Victoria Pde., East Melbourne, Vic.

Department of Public Health, 57 Murray St., Perth, W.A. 6000.

Austria

*Austrian Society of Industrial Medicine, Sensengasse 2, A 1090 Vienna.

Belgium

*Centre Scientifique et Technique de la Construction, 5 Rue de la Violette, B-1000 Brussels.

Brazil

*Associação Brasileira de Prevençâo à Poluição do Ar, Departamento de Saúde Ambiental, Faculdade de Saúde Publica, Caixa Postal 8099, Sáo Paulo, Brazil.

Canada

*British Columbia Clean Air Association, 2907 West 42nd Avenue, Vancouver 13, B.C.

Department of Fisheries & Forestry, Air Pollution Control Division, c/o Environmental Health Centre, Tunney's Pasture, Ottawa 3, Ontario.

Czechoslovakia

1. Technical University of Prague, Faculty of Mechanical Engineering, Environmental Engineering Department, Suchbátarova 4, Praha 6.
2. Czechoslovak Academy of Sciences, Institut for Physics of the Atmosphere, Boční 11, Praha 4.
3. Institute of Hygiene and Epidemiology, Institute of General and Communal Hygiene, Šrobárova 48, Praha 10.
4. Power Research Institute, Partyzánská 7a, Praha 7.
5. Research Institute of Air Engineering, Počernická 96, Praha 10.
6. Hydrometeorological Institute, Department for Air Pollution Prevention, Pujmanové V-8, Praha 4.
7. State Technical Inspection for Air Pollution Control, Italská 27, Praha 2.
8. Czechoslovak Research and Development Center for Environmental Pollution Control — UNO/WHO Programme, Bratislava—Karlova Ves.

Denmark

Dansk Kedelforening and Danish Air Pollution Laboratory, Sankt Peders Vej 8, 2900 Hellerup.

National Health Service of Denmark, 1 St. Kongensgade, 1264 Copenhagen K.

Finland

Finnish Council for Air Conservation and Noise Abatement, Haartmaninkatu 1, 00290 Helsinki 29.

Ministry of Interior Affairs, Hallituskatu 4 E, 00170 Helsinki 17.

France

Association pour la Prévention de la Pollution Atmosphérique. M. Yvan QUERET, 62, rue de Courcelles, 75—PARIS 8°

Association Technique de l'Industrie du Gaz en France, 62, rue de Courcelles, 75—PARIS 8°

Centre d'Information pour le Dévelopement de Conditionnement d'Air, de la Ventilation, du Filtrage de l'Air et du Dépoussierage, 38, rue Copernic 75—PARIS 16°

Centre Interprofessionnel Technique d' Etudes de la Pollution Atmosphérique (C.I.T.E.P.A.), 28, rue de la Source, 75—PARIS XVIè.

Charbonnages de France, 9 avenue Percier, 75—PARIS 8°

Centre d'Etudes et de Recherches de Charbonnages de France (CERCHAR) 35, rue Saint-Dominique 75—PARIS 7°

Comité de coordination pour la Prévention de la Pollution Atmosphérique which comprises the following: 21, rue Murillo 75 —PARIS 8° Président: M. le Professeur MOUREU:

Association pour la Prévention de la Pollution Atmosphérique (A.P.P.A.) 62 rue de Courcelles 75—PARIS 8°

Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique (C.I.T.E.P.A.). 28, rue de la Source 75—PARIS 16°

Comité National d'Action pour l'Assainissement de l'Atmosphère (C.A.P.A.), 54, avenue Marceau 75—PARIS 8°

Centre de Recherches pour la Pollution Atmosphérique (INSERM-C.R.P.A.) 3, rue Léon Bonnat 75—PARIS 16° 44, Chemin de Ronde 78—LE VESINET (Directeur le Professeur ROUSSEL).

Centre National de la Recherche Scientifique (C.N.R.S.) 15, quai Anatole France 75—PARIS 7°

Délégation Générale à la Recherche Scientifique et Technique 103, rue de l'Université 75—PARIS 7°

Electricité de France, 11 bis, rue d'Aguesseau, 75—PARIS 8°

Professeur ROUSSEL directeur de l'INSERM 11 bis rue de Milan, 75—PARIS 9°

Institut Français des Combustibles et de l'Energie, 3 rue Henri Heine, 75—PARIS 16°

Institut Français du Pétrole (I.F.P.) 1 et 4 avenue Bois Préau 92—RUEIL MALMAISON.

Institut National de Recherche Chimique Appliquée, 12, Quai Henry IV 75—PARIS 4°

Laboratoire Central de la Préfecture de Police, 39, bis rue de Dantzig 75—PARIS 15°

Laboratoire "Prévention de la Pollution Atmosphérique" d'Electricité de France, 1, quai de Saint Ouen 93—SAINT DENIS.

Société Française des Pétroles BP, 21 rue de la Bienfaisance, 75—PARIS 8°

Union Européenne de Médecine Sociale, 21 rue Murillo 75—PARIS 8°

Germany

Abgasprüfstelle der DDR, Rudower Chaussee 6, 1199 Berlin-Adlershof.

Agrikulturchemisches Institut, Am Vogelsang 14, 5628 Heiligenhaus Bez. Düsseldorf.

Bundesgesundheitsamt, Institut für Wasser-, Boden- und Lufthygiene, Corrensplatz 1, 1000 Berlin 33.

Bundesministerium des Innern, Rheindorfer Str. 198, 5300 Bonn.

Deutsche Gesellschaft für Mineralölwissenschaft und Kohlechemie e.V., Mittelweg 180, 2000 Hamburg 13.

Deutscher Städtetag, Lindenallee 11, 5000 Köln-Marienburg.

Deutscher Verein von Gas- und Wasserfachmännern, Beethovenstr. 17, 6000 Frankfurt (Main).

Gaswärme-Institut Essen e.V., Holbeckshof, 4300 Essen-Steele.

Hygienisches Institut, Neuer Kamp 25, 2000 Hamburg 6.

Hygiene-Institut der Humboldt-Universität, Otto-Grotewohl-Str. 1, 108 Berlin, DDR.

Institut für Gewerbliche Wasserwirtschaft und Luftreinhaltung e.V., Oberländer Ufer 84-88, 5000 Köln 51.

Institut für Grubensicherheit und Arbeitsschutz, Kirchgasse 11, Freiberg/Sa., DDR.

Institut für Technische Physik der Frauen-hofer-Gesellschaft, Königstr. 70/74, 7000 Stuttgart-Degerloch. Director: Prof. Dr.-Ing. Gösele.

International Union for Conservation of Life (IUCL) Secretariate: Institut für Biologie und Lebensschutz, 6229 Schlangenbad-Georgenborn.

Landesinstitut für Arbeitsschutz und Arbeitsmedizin, Kaiserallee 61, 7500 Karlsruhe.

Landesanstalt für Immissions- und Boden-nutzungsschutz des Landes Nordrhein-Westfalen, Wallneyer Str. 6, 4300 Essen.

Rhein.-Westf. Technischer Überwachungs-Verein e.V., Steubenstr. 53, 4300 Essen.

Ruhrkohlen-Beratung GmbH, Frau-Bertha-Krupp-Str. 4, 4300 Essen.

Staubforschungsinstitut des Hauptverbandes, der Geweblichen Berufsgenossenschaften e.V., Langwartweg 103, 5300 Bonn.

Steinkohlenbergbauverein, Friedrichstr. 2, 4300 Essen.

Verein Deutscher Eisenhüttenleute, Breite Str. 27, 4000 Düsseldorf.

Verein Deutscher Ingenieure (VDI)—Kommission Reinhaltung der Luft—Graf-Recke-Str. 84, 4000 Düsseldorf, Secretary: N. Endell.

Vereinigung der Groβkesselbetreiber e.V., Klinkestr. 29/31, 4300 Essen.

Vereinigung de Technischen Überwachungs-Vereine e.V. 43 Essen, Rott str. 17.

India

*All Indian Institute of Hygiene and Public Health. Industrial Health Research Unit, Section of Physiological and Industrial Hygiene, Calcutta.

Central Public Health Engineering Research Institute, 70-71 Civil Lines, Nagpur.

Israel

Ministry of Health, Division for Air Pollution and Radiation Control, 27 Prof. Shor Street, Tel-Aviv.

Public Council for the Prevention of Noise and Air Pollution in Israel, Tel-Aviv, P.O. Box 6335.

Italy

Consiglio Nazionale delle Ricerche Pizzale delle Scienze 7, Rome.

ILVA Society, Via Corsica 4, Genoa.

Institute of Hygiene, University of Ferrara, Corso Giovecca 173A, Ferrara.

Institute of Hygiene, University of Genoa, Via A. Pastore 1, Genoa.

Instituto di Ingegneria Sanitaria del Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milan.

Istituto Superiore di Sanità, Viale Regina Elena 299, Rome.

N.A.N.S. (Union of Natons for Fight against Noise and Smog), Belvedere Golfo Paradiso 49-16036-Recco-Genova.

Stazione Sperimentale per i Combustibili, Viale De Gasperi 3, San Donato Milanese, Milan.

***Japan**

The Institute of Public Health, 1-39, Shiba Shirogane Daimachi, Minato-ku, Tokyo.

Kanto-Shin-Etsu Heat Control Society, 54 Takata-Oimatsu-cho, Bunkyo-ku, Tokyo.

Osaka Institute of Hygiene, 38 Kitaogimachi, Kita-Ku, Osaka.

Malta

National Society for Clean Air, 8-10 Civic Centre, Senglea.

Mexico

Asociacion Mexicana Contra la Contaminacion del Agua y del Aire, A.C., Toree de Ciencias 50 Piso, Ciudad Universitaria, México 20, D.F., México.

Netherlands

Environmental Health Division, Municipal Health Service, Baan 170, Rotterdam.
Duinweg, The Hague.

Central Organisation T.N.O., 148
Atmospheric Pollution Division, 14 Juliana van Stolberglaan, P.O. Box 148, The Hague.

Council for Air Pollution, Zeestraat 73, The Hague.

Netherlands Association for Water, Soil and Air Pollution, Nieuwe Achtergracht 100, Amsterdam.

Research Institution for Public Health Engineering T.N.O. (organisation for Health Research T.N.O.) Industrial Air Pollution Division, 97 Schoemakerstraat, Delft.

Stichting Concawe (International Study Group for Conversation of Clean Air and Water in Western Europe). Secretary E. H. Hubbard, 21 President Kennedylaan, The Hague.

SICOM, Stichting International Contactorgaan Milieubescherming, Postbus 214, Delft, The Netherlands.

New Zealand

New Zealand Clean Air Society Inc., P.O. Box 2365, Christchurch, New Zealand.

Norway

Institute of Hygiene, University of Oslo, Gydas Vei 8, Oslo 3.

Norwegian State Council for Air Pollution Abatement, Røykskaderädet, Oslo Dep., Oslo 1.

Norwegian Institute for Air Research, P.O. Box 15, N-2007 Kjeller/Oslo, Norway.

SINTEF avd. 21, 7034 Trondheim—NTH, Norway.

Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.), Den Norske Ingeniørforening, Kronprinsensgate 17, Oslo 2, Norway.

Poland

The Ministry of Local Economy and Environment Protection, Nowogrodzka 1/3, Warsaw.

Portugal

*Instituto Superior Ciencias, Sociais Universidade Técnica, Lisbon.

Peru

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire, Jr, Moquegua 336-Of. 206, Lima, Peru.

South Africa

Air Pollution Research Group of the Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, Transvaal.

Chemical Engineering Group of the Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, Transvaal.

D. Giles and Co. (Scientific) (Pty) Ltd., P.O. Box 3891, Johannesburg, Transvaal.

National Association for Clean Air, P.O. Box 5777, Johannesburg, Transvaal.

Corner House Laboratory (1968) (Pty) Ltd., Private Bag XI, Emmarentia, Transvaal.

Spain

Municipal Institute of Hygiene, Place de Lesseps, 1 Barcelona.

Sweden

National Swedish Environment Protection Board, Fack S-17120, Solna 1.

Swedish Water and Air Pollution Research Laboratory, Djurgårdsgatan 26, Box 4052 S-40040, Göteborg 4.

International Meteorological Institute in Stockholm, P.O.B. 19111, 10432 Stockholm 19.

Swedish Meteorological and Hydrological Institute, Fridhemsgatan 9, Box 12108, S-10223 Stockholm.

AB Bahco, S-19901 Enköping 1.

AB Svenska Fläktfabriken, Box 20 040, S-10460 Stockholm 20.

Switzerland

Eidgenossische Kommission fur lufthygiene, Monbijoustr, 8, 3003 Berne.

Schweiz. Vereinigung für Gesundheitstechnik (SVG), Postfach 305, 8035 Zurich, Switzerland.

U.S.A.

Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, 15213.

Bituminous Coal Research Inc., 35 Hochberg Road, Monroe, Pittsburgh 13, PA.

National Air Pollution Control Administration, 801 N. Randolph Street, Arlington, Virginia 22203.

Other U.S. Governmental Air Pollution Agencies and individual State Agencies are listed in an annual Directory published by the Air Pollution Control Association in co-operation with the U.S. Dept. of Health, Education and Welfare. A copy of this Directory is available at the library of the National Society for Clean Air.

Uruguay

Asociacion Uruguaya Contra la Contaminacion del Aires, Calle Colonia 1422, P.6, Ap. 601 Montevideo, Uruguay.

U.S.S.R.

*Institute of Communal Hygiene, Pogodinskaja 10, Moscow.

Medical Control Committee on Air Pollution, State Medical Commission, Moscow.

World Health Organization

Division of Environment Health, 20 Avenue Appia, Geneva, Switzerland.

The United Nations Economic Commission for Europe

Division of Environment and Housing, Palais des Nations, Geneva, Switzerland.

Yugoslavia

Yugoslav Committee for Chemical Engineering, Section of Air Pollution Prevention, Sarajevo, Omladinsko setaliste bb, Yugoslavia.

Air Year Book" as no reply received
*Entry taken from last issue of "Clean from enquiry.

TRADE DIRECTORY AND BUYERS GUIDE

page
Adjustable Roof Plate (PVC and Polypropylene) ... 95
Air Conditioners (Domestic) ... 95
Air Conditioning Equipment ... 95
Air Pollution Measurement ... 95
Anti-Soot and Corrosion Treatment ... 95
Automatic Control Equipment ... 95

Bacteria Sampling Equipment ... 95
Bifurcated Fans (PVC and Polypropylene) ... 96
Blowers ... 96
Boilers, Domestic ... 96
Boilers, Industrial ... 96
Boilers, Industrial (Solid Fuel) ... 96
Boilers, Industrial (Waste-Fired) ... 96
Boilers, Packaged (Oil-Fired) ... 96
Boiler Tube Cleaning Equipment ... 96
Brickwork, Boiler Setting ... 96
Brushes (Tube) ... 96
Burners, Gas ... 96
Burners, Oil... ... 96
Burners, Solid Fuel ... 96

Canopy Hood ... 96
Ceilings, Heated ... 96
Centrifugal Fans (PVC and Polypropylene) ... 97
Chimneys ... 97
Chimneys (Insulated) ... 97
Chimney Cladding (Aluminium) ... 97
Chimney Linings ... 97
Clean Rooms ... 97
Coal Handling Plant ... 97
Contractors, Heating, Ventilating & Air Conditioning ... 97
Coolers ... 97

Dampers, Gas-Tight ... 97
Dehumidifiers ... 98
Discharge Valves ... 98
Ducting ... 98
Duct Heaters ... 98
Dust Classification Plant ... 98
Dust Collection Equipment ... 98
Dust Collection Equipment & Plant ... 98
Dust Collectors ... 98
Dust Collector Filter Media ... 99
Dust Sampling Equipment ... 99

Electrical Precipitators ... 99
Electric Vehicles ... 99

Fabric Filters ... 99
Fans ... 99
Filters ... 99
Filters, Air ... 99
Filters, Dust ... 99
Filters, Electrostatic Oil Mist ... 100
Filter Paper ... 100
Flares ... 100
Flue Dust Extraction Plant ... 100
Flue Gas Dust Monitoring Device (C.E.G.B. Type) ... 100
Flue Gas Treatment ... 100
Fuel Additives ... 100
Fuel Efficiency Advisory Service ... 100
Fuel - Electricy Supply ... 100
Fuel - Gas ... 100

page
Fuel Oil Combustion Improver ... 100
Fuels (Solid Smokeless) ... 100
Fume Removal Equipment ... 101
Furnaces, Kilns, Ovens, etc. ... 101

Gas Cleaning Plant ... 101
Gas H_2S ... 101
Gas Heating Equipment (Butane/Propane) ... 101
Gas Scrubbers & Washers ... 101
Gas Unit Heaters ... 102
Grit Arresters ... 102

Heat Exchangers ... 102
Heaters, Air ... 102
Heaters - Infra Red ... 102
Heating Equipment, Industrial (Process Space) ... 102
Heating Systems - Electric ... 102
Heating Systems - Gas ... 102
Heating Systems - Oil ... 102
Humidifiers ... 103

Incandescent/Whiting Wet Arresters for Cupolas ... 103
Incinerators ... 103
Indicators, Humidity ... 103
Industrial Boilers ... 103
Instruments, Gauges, Meters, etc. ... 103

Laboratory Fume Cabinets ... 103
Lecture, Filmstrips & Notes ... 103

Odour Control ... 103

Pollution Control Advisory Services ... 104
Pumps ... 104

Radiant Heating ... 104
Refrigeration Plant ... 104
Research and Development Facilities ... 104
Roof Ventilators (PVC) ... 104
Room Heaters - Gas ... 104

Sleeves & Tubes (For Fabric Filters) ... 104
Smoke Density Gauges & Meters ... 104
Smoke Indicators ... 104
Smut Inhibitors ... 104
Steam Condenser Unit (Polypropylene) ... 105
Stokers, Industrial ... 105

Tanks and Tank Linings ... 105
Thermal Storage Systems ... 105
Thermometers, Indicators, etc. ... 105
Thermostats ... 105
Tube Cleaning Machines ... 105
Tube Cleaning Tools & Brushes ... 105

Unit Dust Collectors ... 105

Ventilators ... 105

Warm Air Heating Systems ... 105
Waste Fuel Boiler Plant ... 105
Waste Heat Recovery ... 105
Waste Material Disposal Furnaces ... 106
Wet Arresters ... 106
Wire Brushes (Tube and Surface) ... 106

ADJUSTABLE ROOF PLATE (PVC AND POLYPROPYLENE)

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol, BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

AIR CONDITIONERS (DOMESTIC)

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460-1117) Telex 896501
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

John Bass Limited
John Bass Works, Ashley Crescent (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd", offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

AIR CONDITIONING EQUIPMENT

Aeronca International Ltd.
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).
Penarth Road, Cardiff CF1 7UG (Cardiff 37873).

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London, SW1E 5EL (01-834 6858) Telex 23581.

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

John Bass Ltd.
John Bass Works, Ashley Crescent, (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd." offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

Marston Refrigeration Ltd.
Marston House, Dockfield Road, Shipley, Yorkshire (Shipley 52288) Telex 55432.
The "Marstair" packaged range consists of air or water cooled vertical units with capacities from 3 to 20-tons and glass fibre cased roof mounted units within the same range.
The "Airking" packaged range of smaller room units has capacities from 12,000 *to* 18,000 *Btu/hr.*

Ozonair Engineering Company Ltd.
Aylesford, Maidstone, Kent (Maidstone 77861).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

Thermotank Products
A division of Hall Thermotank International, 150 Helen Street, Glasgow G51 3HH (041-445-2444) Telex 77616.
Southern Sales Office: 232/242, Vauxhall Bridge Road, London S.W.1. (01-834-2417) Telex 24543.

AIR POLLUTION MEASUREMENT

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N.1. (01-253-8581).

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Surrey (Byfleet 43224/5). Telegrams: Capumps, Byfleet. Telex 928368.
Charles Austen Pumps Ltd., manufacture a range of "oil free" diaphragm pumps suitable for continuous operation for sampling CO_2, SO_2 furnace gases, sulphur fumes etc., the range covers flow rates from 0 *to* 70 *litres per minute.*

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts, SG1 2DE (Stevenage 3101-5) Telex 82385.
Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ—500μ), *Radio Active Particle Measuring Equipment and H_2S Gas Monitors* (10*ppm Alarm Level*).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

ANTI-SOOT AND CORROSION TREATMENT

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
Manganese Amine.

DCP Systems Ltd.
Centre Heights, 137 Finchley Road, London NW3 6JD (01-586-1121).

Polar Industrial Chemicals Ltd.
34 Ebury Street, London S.W.1. (01-730-7158) (*Polar Panorin*).
Manufacturers of treatments to alleviate air pollution and related problems in industrial boilers, such as sulphuric acid, vanadium, NOx emissions and unburnt carbon. The cost benefit is the maintenance of efficiency over long operating periods.

AUTOMATIC CONTROL EQUIPMENT

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

Thermotank Products
A division of Hall Thermotank International, 150 Helen Street, Glasgow G51 3HH (041-445-2444) Telex 77616.
Southern Sales Office: 232/242, Vauxhall Bridge Road, London S.W.1. (01-834-2417) Telex 24543.

BACTERIA SAMPLING EQUIPMENT

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N.1. (01-253-8581).

BIFURCATED FANS (PVC AND POLYPROPYLENE)

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

BLOWERS

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N.19 (01-272-0233) Telex 263206.
Turbo exhausters and blowers can supply air free from moisture or oil. Rotary piston blowers, precision made, robust, suitable for use in countless fields of application from nuclear engineering to the refrigeration industry.

BOILERS, DOMESTIC

Ideal-Standard Ltd.
P.O. Box 60, Kingston Upon Hull (Hull 46461).
Product: Concord RS/CF (Gas); E Type (Gas); Concord W10/15 (Gas); Concord H (Gas).

BOILERS, INDUSTRIAL

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts. (Potters Bar 57201) Telex 261076.
Works: Hoval Farrar Boilers Ltd., Newark-on-Trent, Notts.

BOILERS, INDUSTRIAL (SOLID FUEL)

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

BOILERS, INDUSTRIAL (WASTE-FIRED)

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

BOILERS, PACKAGED (OIL-FIRED)

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

BOILER TUBE CLEANING EQUIPMENT

Rotatools (U.K.) Ltd.
Pembroke Works, 43/45 Pembroke Place, Liverpool L3 5PH (051-709-6117)
"Rotatool" products embrace the whole range of manual and mechanical tube cleaning equipment for Tubular Boilers and all makes and design of auxiliary Tubular Plant such as Economisers, Evaporators, Condensers, Air Heaters, etc.

BRICKWORK, BOILER SETTING

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

BRUSHES (TUBE)

Rotatools (U.K.) Ltd.
Pembroke Works, 43/45 Pembroke Place, Liverpool L3 5PH (051-709-6117)
"Rotatool" products embrace the whole range of manual and mechanical tube cleaning equipment for Tubular Boilers and all makes and design of auxiliary Tubular Plant such as Economisers, Evaporators, Condensers, Air Heaters, etc.

BURNERS, GAS

The Aerogen Company Ltd.
Anstey Mill Lane, Alton, Hampshire. (Alton 83744) Telex 85194.

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

Phoenix Burners Ltd.
16 Phillimore Place, London W.8. (01-937-8359).

BURNERS, OIL

Babcock and Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

BURNERS, SOLID FUEL

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

CANOPY HOOD

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

CEILINGS, HEATED

Phoenix Burners Ltd.
16 Phillimore Place, London W.8. (01-937-8359).
Phoenix Slimline suspended, gas fired, infra-red radiant heating system for offices, shops, schools, etc. features: draft-free warmth, recessed installation or attractive exposed appearance, avoids condensation problems, gives 92% fuel efficiency and is compatible with air conditioning.

CENTRIFUGAL FANS (PVC AND POLYPROPYLENE)

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

Ozonair Engineering Company Ltd.
Aylesford, Maidstone, Kent (Maidstone 77861).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

CHIMNEYS

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274-4066).
Woodlands Road, Mere, Warminster, Wilts. (Mere (0747) 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021-552-2039).
"Beauvent" self-supporting and boiler mounted steel chimneys; "Beauvent Econoflu" self-supporting multi-taper steel chimneys; "Beauvent Concentriflu" concentri-bore steel chimneys "Beauvent Insulflo" insulated double shell steel chimneys; "Beaumere" multi-bore insulated steel chimneys incorporating oil and water storage tanks; "Beauval" aluminium insulation cladding for "Beauvent" chimneys; "Beauval Supercladding" heavy duty insulation for "Beauvent" chimneys; "Beaufix" retaining bands for brick chimneys; "Clements-Beauvent" multi-flue insulated steel chimneys.

CHIMNEYS (INSULATED)

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274-4066).
Woodlands Road, Mere, Warminster, Wilts. (Mere (0747) 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021-552-2039).
"Beauvent" self-supporting and boiler mounted steel chimneys; "Beauvent Econoflu" self-supporting multi-taper steel chimneys; "Beauvent Concentriflu" concentri-bore steel chimneys "Beauvent Insulflo" insulated double shell steel chimneys; "Beaumere" multi-bore insulated steel chimneys incorporating oil and water storage tanks; "Beauval" aluminium insulation cladding for "Beauvent" chimneys; "Beauval Supercladding" heavy duty insulation for "Beauvent" chimneys; "Beaufix" retaining bands for brick chimneys; "Clements-Beauvent" multi-flue insulated steel chimneys.

Thermotank Products
A division of Hall Thermotank International, 150 Helen Street, Glasgow G51 3HH (041-445-2444) Telex 77616.
Southern Sales Office: 232/242, Vauxhall Bridge Road, London S.W.1. (01-834-2417) Telex 24543.

CHIMNEY CLADDING (ALUMINIUM)

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274-4066).
Woodlands Road, Mere, Warminster, Wilts. (Mere (0747) 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021-552-2039).
"Beauvent" self-supporting and boiler mounted steel chimneys; "Beauvent Econoflu" self-supporting multi-taper steel chimneys; "Beauvent Concentriflu" concentri-bore steel chimneys "Beauvent Insulflo" insulated double shell steel chimneys; "Beaumere" multi-bore insulated steel chimneys incorporating oil and water storage tanks; "Beauval" aluminium insulation cladding for "Beauvent" chimneys; "Beauval Supercladding" heavy duty insulation for "Beauvent" chimneys; "Beaufix" retaining bands for brick chimneys; "Clements-Beauvent" multi-flue insulated steel chimneys.

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CHIMNEY LININGS

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Southern Sales Office: 232/242, Vauxhall Bridge Road, London S.W.1. (01-834-2417) Telex 24543.

CLEAN ROOMS

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772-5102/3).
Dashwood Avenue, High Wycombe, Bucks. (High Wycombe 22744).

John Bass Ltd.
John Bass Works, Ashley Crescent, (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd." offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

COAL HANDLING PLANT

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

CONTRACTORS, HEATING, VENTILATING & AIR CONDITIONING

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London SW1E 5EL (01-834-6858) Telex 23581.
Carrier act as consultants and as designers and contractors for air conditioning, clean air and environmental control systems and for industrial process heating systems, with associated electrical and mechanical services including boiler house installation.

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772-5102/3).
Dashwood Avenue, High Wycombe, Bucks. (High Wycombe 22744).

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

COOLERS

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

Redman Heenan Froude Ltd.
Worcester Engineering Works, Shrub Hill Road, Worcester WR4 9EQ (Worcester 23461) Telex 339636.
Trade Names: Heenan, Heenan Marley, Aquatower. A range of evaporative type water coolers with capacities from 250-600,000 gallons/hour.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

DAMPERS, GAS-TIGHT

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

DEHUMIDIFIERS

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Thermotank Products
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DISCHARGE VALVES

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

DUCTING

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

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DUCT HEATERS

The Aerogen Company Ltd.
Anstey Mill Lane, Alton, Hampshire. (Alton 83744) Telex 85194.

DUST CLASSIFICATION PLANT

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

DUST COLLECTION EQUIPMENT

Midac Dust Control
Bedford Road, Birmingham B11 1AY (021-772-3781).

DUST COLLECTION EQUIPMENT & PLANT

Aeronca International Ltd.
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).
Penarth Road, Cardiff CF1 7UG (Cardiff 37873).

Airmaster Engineering Ltd.
Olympia Works, Roundhay Road, Leeds LS8 4BH (Leeds 656494). Telex 557227.

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Centri-Spray International
Green Dragon House, 64/70 High Street, Croydon, CR9 1LG, Surrey (01-688-7431). Telex 261251.

Centri-Spray GmbH.
Lloyd Haus, Barbarossa Platz 4, Koln 5, West Germany.

Centri-Spray Sarl
125 Rue Anatole France, Noisy-Le-Sec 93, France.

Collection (Dust Control) Ltd.
5 Greenhills Road, Charlton Kings, Cheltenham, Gloucestershire GL53 9ED (Cheltenham 56355).

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772-5102/3).
Dashwood Avenue, High Wycombe, Bucks. (High Wycombe 22744).

Dust Control Equipment Ltd.
Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222). Telex 51306.
There is no single, simple solution that can be universally applied to dust collection and control problems. A variety of factors can influence the choice of plant in any given situation. Very fine dusts or the combination of certain gases can for example result in fire or explosion. Acid gases present corrosion problems which must be examined at the design stage. The volume and temperature of the gas, the density and composition of the particles and the ultimate disposal of the collected material must all be considered. It is therefore essential to consult a company which can give unbiased advice on problems associated with dust collection and control. To be able to do this the company concerned should not be restricted to one or two types of plant only—it should, like Holmes, design and manufacture a comprehensive range. This, coupled with the extensive chemical and mechanical engineering know-how gained in supplying complete flow sections for the process industries ensures that a Holmes plant will offer maximum economic and operational advantages.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

Midac Dust Control
Bedford Road, Birmingham B11 1AY (021-772-3781).

Nailsea Engineering Co. Ltd.
The Grange, East Park Road, Blackburn, Lancashire (Blackburn 63911). (*Pnu-Jet dust filters and collectors) Pnu-Jet dry dust collectors and filters are manufactured by Nailsea Engineering Co. Ltd. of Blackburn. Applications particularly in mining, quarrying and road stone preparation. Nailsea equipment is guaranteed to cope with the requirements of the Alkali Act.*

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

R. J. Richardson & Sons Ltd.
37 Commercial Street, Birmingham B1 1RS (021-643-2281-5) (P.B.X.)

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire WF5 9AW (Ossett 5121) Telex 55201.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

DUST COLLECTORS

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N.19 (01-272-0233) Telex 263206.
M-40-A and 584 multi cyclone dust and powder collections enable the recovery of saleable fines and minimise air pollution. These machines are suitable for the food industry.

DUST COLLECTOR FILTER MEDIA

Bury & Masco Industries Ltd.
Needlefelt Division, Myrtle Grove, Waterfoot, Rossendale, Lancs., BB4 7JL (Rossendale (07-062) 5414).
Webron filtering products are designed to give increased air to cloth ratio on automatic filters. Webron media have been successfully applied on most known makes of dust filter giving better life and service than conventional media.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

DUST SAMPLING EQUIPMENT

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N.1. (01-253-8581).

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts, SG1 2DE (Stevenage 3101-5) Telex 82385.
Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ—500μ), Radio Active Particle Measuring Equipment and H_2S *Gas Monitors (10ppm Alarm Level*).

ELECTRICAL PRECIPITATORS

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Redman Heenan Froude Ltd.
Worcester Engineering Works, Shrub Hill Road, Worcester WR4 9EQ (Worcester 23461) Telex 339636.
Trade Name: Heenakleen. An electrofilter tower using high voltage and continuous irrigation eliminates smoke and limits release of harmful gases into the atmosphere.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N.19 (01-272-0233) Telex 263206.
Easily maintained precipitators. Specially designed for gas cleaning, in power stations, cement works, refuse disposal installations etc. Efficiency up to 99.99% obtained. "Industrap" modular unit also available for smaller applications.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

ELECTRIC VEHICLES

The Electric Vehicle Association of Great Britain
Trafalgar Buildings, 1 Charing Cross, London S.W.1 (01-930-6757) (*On road and Off road Electric Vehicles*).

FABRIC FILTERS

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Bury & Masco Industries Ltd.
Needlefelt Division, Myrtle Grove, Waterfoot, Rossendale, Lancs., BB4 7JL (Rossendale (07-062) 5414).
Webron filtering products are designed to give increased air to cloth ratio on automatic filters. Webron media have been successfully applied on most known makes of dust filter giving better life and service than conventional media.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Ozonair Engineering Company Ltd.
Aylesford, Maidstone, Kent (Maidstone 77861).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

FANS

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

Midac Dust Control
Bedford Road, Birmingham B11 1AY (021-772-3781).

Ozonair Engineering Company Ltd.
Aylesford, Maidstone, Kent (Maidstone 77861).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N.19 (01-272-0233) Telex 263206.
S 200 Series Radialine fans with backward aerofoil blades in tubular housing for optimum performance with straight through air flow. Suitable for heating ventilating and industrial applications.
S 400 Series paddle bladed fans for handling materials in powder or granular form.
SE 500 Series Monogram Cast Iron fans with radial or curved bladed impeller for diverse industrial applications.
SE 1000 Series forward curved fans for many applications, requiring high gas flow at low pressure.
S 8000 Series aerofoil bladed fans for a wide range of industrial uses needing high throughput with low power requirements.

FILTERS

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N.19 (01-272-0233) Telex 263206.
Electrostatic air filters from 1 sq. ft. area upwards for heating and ventilating and light industrial uses. They feature high efficiencies of up to 99%. Viscous type air filters. "Fleetway" paper air filters available with a range of element grades. "Hampton" heavy duty filter panels which are washable.

FILTERS, AIR

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

GKN Farr Filtration Ltd.
31-38 Moseley Street, Birmingham B5 6LJ (021-622-4551) Telex 337065.

John Bass Ltd.
John Bass Works, Ashley Crescent, (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd." offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

Midac Dust Control
Bedford Road, Birmingham B11 1AY (021-772-3781).

Nailsea Engineering Co. Ltd.
The Grange, East Park Road, Blackburn, Lancashire (Blackburn 63911).
(*Pnu-Jet dust filters and collectors*) *Pnu-Jet dry dust collectors and filters are manufactured by Nailsea Engineering Co. Ltd. of Blackburn. Applications particularly in mining, quarrying and road stone preparation. Nailsea equipment is guaranteed to cope with the requirements of the Alkali Act.*

Ozonair Engineering Company Ltd.
Aylesford, Maidstone, Kent (Maidstone 77861).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

FILTERS, DUST

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Dust Control Equipment Ltd.
Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

FILTERS, ELECTROSTATIC OIL MIST

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N.19 (01-272-0233) Telex 263206.
For industrial applications involving oil fume removal with efficiencies of up to 99%.

FILTER PAPER

Evans, Adlard & Co. Ltd.
Postlip Mills, Winchcombe, Cheltenham, Glos., GL54 5BB (0242-602227) Telex 43316 (*Postlip Filter Paper*).

FLARES

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

FLUE DUST EXTRACTION PLANT

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London EC1Y 0TD (01-253-1299) Cables: Processes, London E.C.1.
Head Wrightson supply a complete range of flue dust extraction plants which include dry-electrostatic precipitators, irrigated precipitators, fabric filters, multi-cyclones, gas washers and a high efficiency flooded disc scrubber with no blockade throat or sprays.

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

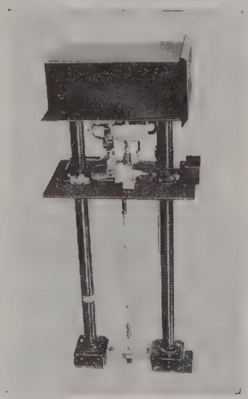
Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Redman Heenan Froude Ltd.
Worcester Engineering Works, Shrub Hill Road, Worcester WR4 9EQ (Worcester 23461) Telex 339636.
Trade Name: Heenakleen. An electrofilter tower using high voltage and continuous irrigation eliminates smoke and limits release of harmful gases into the atmosphere.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

FLUE GAS DUST MONITORING DEVICE (C.E.G.B. TYPE)

Foster Cambridge Ltd.
Sydney Road, Muswell Hill, London N10 2NA (01-883-0071) Telex 25167.



The Foster Cambridge Dust Monitor samples emission of grit and smut particles from chimneys and industrial plant, giving a continuous strip chart record. The monitor is self cleaning and requires minimal maintenance.

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

FLUE GAS TREATMENT

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871) (*Dolomite/Magnesite*).

DCP Systems Ltd.
Centre Heights, 137 Finchley Road, London NW3 6JD (01-586-1121).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

FUEL ADDITIVES

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871) (*Alumag etc.*)

FUEL EFFICIENCY ADVISORY SERVICE

National Industrial Fuel Efficiency Service Ltd.
54/58 Bartholomew Close, London EC1A 7HD (01-606-5906).

FUEL-ELECTRICITY SUPPLY

The Electricity Council
30 Millbank, London SW1P 4RD (01-930-2333).
Marketing Dept: Trafalgar Buildings, 1 Charing Cross, London SW1A 2OS (01-930-6757).

FUEL—GAS

The British Gas Corporation
59 Bryanston Street, Marble Arch, London W1A 2AZ (01-723-7030).

FUEL OIL COMBUSTION IMPROVER

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
Manganese/Amine.

FUEL OIL CONDITIONER

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
Manganese/Amine.

FUELS (SOLID SMOKELESS)

National Carbonising Company Ltd.
Fullarton Lodge, Crow Hill Drive, Mansfield, Notts. (Mansfield 22644).
34 Smith Square, London S.W.1 (01-222-7331).

National Carbonising Company is the Parent Company of N.C.C. (Rexco) Ltd., makers of Rexco Smokeless Fuels—Rexco Nuts (Rexcobrite in Scotland) Multi-Purpose, Ovoids and Rexcoblend—N.C.C. (Coke) Ltd., with plants in Barnsley, Rotherham and Kidsgrove.

National Coal Board
Hobart House, Grosvenor Place, London SW1X 7AE (01-235-2020) (*Anthracite Welsh Dry Steam*)
Coal Products Division: Coal House, Lyon Road, Harrow, Middx. HA1 2EX (01-427-9001).
Homefire—for open fires; Roomheat—for open fires and roomheaters; Phurnacite—for closed appliances and heat storage cookers; Multiheat—for boilers and open fires; Sunbrite—for most appliances, open or closed.

FUME REMOVAL EQUIPMENT

The Aerogen Company Ltd.
Anstey Mill Lane, Alton, Hampshire. (Alton 83744) Telex 85194.

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Centri-Spray International
Green Dragon House, 64/70 High Street, Croydon, CR9 1LG, Surrey (01-688-7431). Telex 261251.

Centri-Spray GmbH.
Lloyd Haus, Barbarossa Platz 4, Koln 5, West Germany.

Centri-Spray Sarl
125 Rue Anatole France, Noisy-Le-Sec 93, France.

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772-5102/3).
Dashwood Avenue, High Wycombe, Bucks. (High Wycombe 22744).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London EC1Y 0TD (01-253-1299) Cables: Processes, London E.C.1.
A complete range of equipment is available to meet every kind of fume removal problem. Experience combined with extensive research and development facilities makes it possible to produce "tailor made" systems to meet individual needs.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Midac Dust Control
Bedford Road, Birmingham B11 1AY (021-772-3781).

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

FURNACES, KILNS, OVENS, ETC.

R. M. Catterson-Smith Ltd.
Woodrolfe Road, Tollesbury, Essex (Tollesbury 342).
Electric resistance furnaces (450°C to 1750°C) in standard styles and sizes and also 'specials' to meet individual requirements for pottery, glass annealing and decoration, stained glass, enamelling, laboratory processes, wire annealing, heat treatment etc.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

GAS CLEANING PLANT

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Centri-Spray International
Green Dragon House, 64/70 High Street, Croydon, CR9 1LG, Surrey (01-688-7431). Telex 261251.

Centri-Spray GmbH.
Lloyd Haus, Barbarossa Platz 4, Koln 5, West Germany.

Centri-Spray Sarl
125 Rue Anatole France, Noisy-Le-Sec 93, France.

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London EC1Y 0TD (01-253-1299) Cables: Processes, London E.C.1.
Head Wrightson have supplied gas cleaning equipment to industry for nearly 30 years and provide "tailor made" systems incorporating electrostatic and wet tube precipitators, blockage proof flooded disc scrubbers, cyclones and fabric filters.

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex TW 13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

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Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

GAS H_2S

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts, SG1 2DE (Stevenage 3101-5) Telex 82385.
Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ—500μ), Radio Active Particle Measuring Equipment and H_2S Gas Monitors (10ppm Alarm Level).

GAS HEATING EQUIPMENT (BUTANE/PROPANE)

Phoenix-Burners Ltd.
16 Phillimore Place, London W.8. (01-937-8359).

GAS SCRUBBERS & WASHERS

Aeronca International Ltd.
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).
Penarth Road, Cardiff CF1 7UG (Cardiff 37873).

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

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16/22 Baltic Street, London EC1Y 0TD (01-253-1299) Cables: Processes, London E.C.1.
Head Wrightson supply "tailor made" scrubber and washer systems. The company provides a complete range of this equipment including electrostatic and wet tube precipitators, blockage proof flooded disc scrubbers, cyclones and fabric filters.

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Lodge-Cottrell Ltd.
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Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

GAS UNIT HEATERS

Wilkins & Mitchell Ltd.
"The Hollies," Hollies Drive, Wednesbury, Staffordshire (021-556-1191) Telex 338337.
"Servisaire" Compact, wall-mounted balanced flue gas heater. Fans assist combustion and expel warm air from lower grille, just above floor level. Completely fail-safe. One simple control. Controllable from clocks and/or thermostats. Fully guaranteed.

GRIT ARRESTERS

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

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195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
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SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

HEAT EXCHANGERS

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

HEATERS, AIR

The Aerogen Company Ltd.
Anstey Mill Lane, Alton, Hampshire. (Alton 83744) Telex 85194.

Ozonair Enginering Company Ltd.
Aylesford, Maidstone, Kent (Maidstone 77861).

Thermotank Products
A division of Hall Thermotank International, 150 Helen Street, Glasgow G51 3HH (041-445-2444) Telex 77616. Southern Sales Office: 232/242, Vauxhall Bridge Road, London S.W.1. (01-834-2417) Telex 24543.

HEATERS—INFRA RED

Phoenix Burners Ltd.
16 Phillimore Place, London W.8 (01-937-8359).

Nor-Ray-Vac suspended, gas fired, infra-red radiant heating system for industrial and commercial buildings features: High standard human comfort, ease of installation, frees all floor space, avoids condensation problems and gives 92% fuel efficiency.

HEATING EQUIPMENT, INDUSTRIAL (PROCESS SPACE)

The Aerogen Company Ltd.
Anstey Mill Lane, Alton, Hampshire. (Alton 83744) Telex 85194.

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London, SW1E 5EL (01-834 6858) Telex 23581.

HEATING SYSTEMS—ELECTRIC

Husqvarna Ltd.
High Lane, Stansted, Essex (Stansted 2611/5).
43 James Watt Place, East Kilbride, Lanarkshire (East Kilbride 29188).
Husqvarna Ltd. manufactures a comprehensive range of domestic central heating systems. Air heating. Water heating. For large and small houses, For huge estates and select developments. Husqvarna Ltd. have a lot of heating experience to offer.

HEATING SYSTEMS—GAS

Husqvarna Ltd.
High Lane, Stansted, Essex (Stansted 2611/5).
43 James Watt Place, East Kilbride, Lanarkshire (East Kilbride 29188).
Husqvarna Ltd. manufactures a comprehensive range of domestic central heating systems. Air heating. Water heating. For large and small houses, For huge estates and select developments. Husqvarna Ltd. have a lot of heating experience to offer.

HEATING SYSTEMS—OIL

Husqvarna Ltd.
High Lane, Stansted, Essex (Stansted 2611/5).
43 James Watt Place, East Kilbride, Lanarkshire (East Kilbride 29188).
Husqvarna Ltd. manufactures a comprehensive range of domestic central heating systems. Air heating. Water heating. For large and small houses, For huge estates and select developments. Husqvarna Ltd. have a lot of heating experience to offer.

HUMIDIFIERS

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

INCANDESCENT/WHITING WET ARRESTERS FOR CUPOLAS

Wellman Incandescent Furnace Co. Ltd.
Cornwall Road, Smethwick, Warley, Worcs. (021-558-3151).

INCINERATORS

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London EC1Y 0TD (01-253-1299) Cables: Processes London E.C.1.
Head Wrightson design, contract and supply (a) municipal type incinerators, featuring the Martin Grate, which are capable of burning 64 tons per hour (b) rotary cone incinerators with throughputs ranging from 0.4 to 3.0 tons per hour.

Hygrotherm Engineering Ltd.
Whitworth House, 115 Princess Street, Manchester M1 6JR (061-236-5323 and 2613) Telex 668703.
22 Charing Cross Road, London W.C.2 (01-836-4181/2).
Research Station: Hulley Road, Macclesfield, Cheshire (Macclesfield 26238).
Elimination of toxic or noxious organic materials in gaseous and liquid effluents is achieved efficiently and economically by Hygrotherm Incinerators. Designs proven in over thirty years' usage and backed by comprehensive research and engineering facilities.

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

Redman Heenan Froude Ltd.
Worcester Engineering Works, Shrub Hill Road, Worcester WR4 9EQ (Worcester 23461) Telex 339636.
Trade Names: Redman Heenan, Rotoburn. A range of units designed for the clean burning of waste from industry, hospitals, offices, etc. Also high temperature units for disposing of difficult wastes, e.g. rubber and plastics within the requirements of the Clean Air Act.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

Victor Products (Wallsend) Ltd.
P.O. Box Wallsend, Northumberland NE28 6PP (Wallsend 628331).
50 Pall Mall, London, S.W.1 (01-930-7142).
Victoria Chambers, Dale Road, Matlock, Derbyshire (Matlock 2318) (*Victor Incinerators*).

Wellman Incandescent Furnace Co. Ltd.
Cornwall Road, Smethwick, Warley, Worcs. (021-558-3151).

INDICATORS, HUMIDITY

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N.1. (01-253-8581).

Foster Cambridge Ltd.
Sydney Road, Muswell Hill, London N10 2NA (01-883-0071) Telex 25167.
Foster Cambridge humidity indicators, recorders and controllers can be supplied to suit all air conditioning and industrial applications.

INDUSTRIAL BOILERS

Kayanson Engineering Ltd.
The Bank House, 13-15 High Street, Chesham, Buckinghamshire (Chesham 2128-9).
Kayanson products include gas and oil fired boilers, hot water range from 70,000-10,000,000 Btu/h. and steam from 500-10,000 lb/h.

INSTRUMENTS, GAUGES, METERS, ETC.

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N.1. (01-253-8581).

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

Foster Cambridge Ltd.
Sydney Road, Muswell Hill, London N10 2NA (01-883-0071) Telex 25167.
Foster Cambridge instruments of mechanical, electrical or electronic types can be supplied for all industrial applications and any process variable.

LABORATORY FUME CABINETS

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

LECTURE, FILMSTRIPS & NOTES

Diana Wyllie Ltd.
3 Park Road, Baker Street, London N.W.1 (01-723-7333/3330).

ODOUR CONTROL

The Aerogen Company Ltd.
Anstey Mill Lane, Alton, Hampshire. (Alton 83744) Telex 85194.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

Izal Ltd.
Thorncliffe, Chapeltown, Sheffield, S30 4YP (0741-5-3171).
Grand Buildings, Trafalgar Square, W.C.2 (01-839-7141).
Airkem (U.S.A.) odour control equipment and products for industrial plant, sewage works, crematoria, hospitals, washrooms etc., are distributed in the U.K. by Izal. The range also includes disinfectants and detergent cleansers with odour counteractant properties.

Midac Dust Control

Bedford Road, Birmingham B11 1AY (021-772-3781).

Peabody Ltd.

17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

SF Air Treatment Ltd.

Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

POLLUTION CONTROL ADVISORY SERVICES

Ecological Engineering Ltd.

Whitworth House, 115 Princess Street, Manchester M1 6JR (061-236-5323 and 2613) Telex 668703.
22 Charing Cross Road, London W.C.2 (01-836-4181/2).
Research Station: Hulley Road, Macclesfield, Cheshire (Macclesfield 26238).
Comprehensive consultancy service to industry on ecological matters, including surveys, monitoring, advice and design of anti-pollution systems and equipment.

PUMPS

Charles Austen Pumps Ltd.

100 Royston Road, Byfleet, Surrey (Byfleet 43224/5). Telegrams: Capumps, Byfleet. Telex 928368.
Charles Austen Pumps Ltd., manufacture a range of "oil free" diaphragm pumps suitable for continuous operation for sampling CO_2, SO_2 furnace gases, sulphur fumes etc., the range covers flow rates from 0 to 70 litres per minute.

Durapipe & Lamberts Sales Ltd.

Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

RADIANT HEATING

Phoenix Burners Ltd.

16 Phillimore Place, London W.8 (01-937-8359).

REFRIGERATION PLANT

Felvic Industries

21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

M.L. Industrial Products Ltd.

Refrigeration Division, 292 Leigh Road, Trading Estate, Slough, Buckinghamshire (Slough 23838) (*Suppliers of Refrigeration Equipment*).

RESEARCH AND DEVELOPMENT FACILITIES

The British Non-Ferrous Metals Research Association

Euston Street, London, NW1 2EU. (01-387-6411) Telex 265094.
The Association studies the air pollution problems of the metal manufacturing industries and provides to members and non-members consultancy services and fume monitoring facilities in connection with all aspects of metal melting and processing.

Carrier Engineering Company Ltd.

Carrier House, Warwick Row, London, SW1E 5EL (01-834 6858) Telex 23581.

Electrical Research Association (ERA)

Cleeve Road, Leatherhead, Surrey (Leatherhead 74151).

ERA Environmental Sciences Research

High Street, Cranfield, Bedford (Cranfield 771).

Head Wrightson Process Engineering Ltd.

PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London, EC1Y 0TD (01-253-1299) Cables: Processes, London E.C.1.
Head Wrightson have a sophisticated Research and Development Division focused on mechanical and chemical engineering. This division, assists the member companies of the Head Wrightson Group and provides a number of consultancy services to outside companies.

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

ROOF VENTILATORS (PVC)

Durapipe & Lamberts Sales Ltd.

Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

ROOM HEATERS—GAS

Parkinson Cowan Appliances Ltd.

Stechford, Birmingham B33 9AD (021 783-4000). Telex 338068. Telegrams Appliance Birmingham.
Trade Name: Rapide (gas warm air unit heater). Parkinson Cowan Rapide. 10,000 BtU output, room-sealed gas warm air heater. Forced convection gives rapid heat output, even room temperature (pre-selected by built-in thermostat). Weighs 27 lbs., measures 18in. x 20.75in. x 5.25in. Quiet running, quickly installed.

ROOM HEATERS—SOLID FUEL

National Coal Board

Hobart House, Grosvenor Place, London SW1X 7AE (01-235-2020) (*Anthracite Welsh Dry Steam*).
Coal Products Division: Coal House, Lyon Road, Harrow, Middx., HA1 2EX (01-427-9001).
Roomheat—for open fires and roomheaters; Phurnacite—for closed appliances and heat storage cookers; Multiheat—for boilers and open fires; Sunbrite—for most appliances, open and closed.

SLEEVES & TUBES (FOR FABRIC FILTERS)

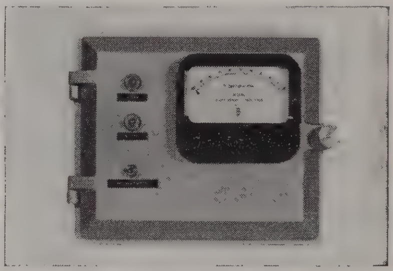
G. F. Rider (Process Plant) Ltd.

Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

SMOKE DENSITY GAUGES & METERS

Photoelectronics (Arcall) Ltd.

Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).



A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

SMOKE INDICATORS

Photoelectronics (Arcall) Ltd.

Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

Ronald Trist Controls Ltd.

Bath Road, Slough, Bucks. (Slough 34646) (*Electricon Smoke Density Indicators and Alarms*).

SMUT INHIBITORS

Combustion Chemicals Ltd.

Burwood Works, Chertsey, Surrey (Chertsey 63871) (*Fuel and Flue Gas Treatments*).

STEAM CONDENSER UNIT (POLYPROPYLENE)

Durapipe & Lamberts Sales Ltd.

Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

STOKERS, INDUSTRIAL

Babcock & Wilcox Ltd.

165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

TANKS & TANK LININGS

Durapipe & Lamberts Sales Ltd.

Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

THERMAL STORAGE SYSTEMS

Carrier Engineering Company Ltd.

Carrier House, Warwick Row, London, SW1E 5EL (01-834 6858) Telex 23581.

Metro-Flex Group of Companies

Metro-Flex Works, Earl Road, London S.E.1 (01-237-8241) Telex 885754.
Metro-Flex gas-tight isolating valves increase plant availability, save fuel, reduce smuts and low temperature corrosion, reduce maintenance costs. Unique flexible metal sealing elements ensure lasting tightness of 99.8% to 100%. Used in many arduous conditions.

THERMOMETERS, INDICATORS, ETC.

C. F. Casella & Co. Ltd.

Regent House, Britannia Walk, London N.1 (01-253-8581).

Foster Cambridge Ltd.

Sydney Road, Muswell Hill, London N10 2NA (01-883-0071) Telex 25167.
Foster Cambridge instruments for temperature measurement and control cover mechanical (dial thermometers etc.), moving coil and electronic types with a choice of many standard temperature ranges.

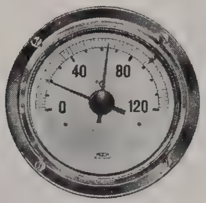
Import Export Machines Supplies Co. Ltd.

50/52 Boscombe Road, London W12 9HU (01-749-2512/3).

THERMOSTATS

Import Export Machines Supplies Co. Ltd.

50/52 Boscombe Road, London W12 9HU (01-749-2512/3).



Programme Consist of: Thermometers, hydrometers, manometers, hydrothermometers, contact-thermometers, contact-manometers, indicating thermostats; thermostats; limitstats; step-controllers; control panels; Mini-Automatic complete boiler controls; electronic thermometers and thermostats.

TUBE CLEANING MACHINES

Rotatools (U.K.) Ltd.

Pembroke Works, 43/45 Pembroke Place, Liverpool L3 5PH (051-709-6117)
"Rotatool" products embrace the whole range of manual and mechanical tube cleaning equipment for Tubular Boilers and all makes and design of auxiliary Tubular Plant such as Economisers, Evaporators, Condensers, Air Heaters, etc.

TUBE CLEANING TOOLS & BRUSHES

Rotatools (U.K.) Ltd.

Pembroke Works, 43/45 Pembroke Place, Liverpool L3 5PH (051-709-6117)
"Rotatool" products embrace the whole range of manual and mechanical tube cleaning equipment for Tubular Boilers and all makes and design of auxiliary Tubular Plant such as Economisers, Evaporators, Condensers, Air Heaters, etc.

UNIT DUST COLLECTORS

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Dust Control Equipment Ltd.

Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

Midac Dust Control

Bedford Road, Birmingham B11 1AY (021-772-3781).

SF Air Treatment Ltd.

Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.

Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

VENTILATORS

Durapipe & Lamberts Sales Ltd.

Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

Felvic Industries

21 Napier Road, Bromley, BR2 9JA, Kent (01-460 1117) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

Ozonair Engineering Company Ltd.

Aylesford, Maidstone, Kent (Maidstone 77861).

Thermotank Products

A division of Hall Thermotank International, 150 Helen Street, Glasgow G51 3HH (041-445-2444) Telex 77616.
Southern Sales Office: 232/242, Vauxhall Bridge Road, London S.W.1. (01-834-2417) Telex 24543.

WARM AIR HEATING SYSTEMS

Constant Air Systems Ltd.

Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham 12 (021-772-5102/3).
Dashwood Avenue, High Wycombe, Bucks. (High Wycombe 22744).

Husqvarna Ltd.

High Lane, Stansted, Essex (Stansted 2611/5).
43 James Watt Place, East Kilbride, Lanarkshire (East Kilbride 29188).
Husqvarna Ltd. manufactures a comprehensive range of domestic central heating systems. Air heating. Water heating. For large and small houses. For huge estates and select developments. Husqvarna Ltd. have a lot of heating experience to offer.

WASTE FUEL BOILER PLANT

G. F. Rider (Process Plant) Ltd.

Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

WASTE HEAT RECOVERY

Babcock & Wilcox Ltd.

165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London, SW1E 5EL (01-834 6858) Telex 23581.

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside, TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London EC1Y 0TD (01-253-1299) Cables: Processes, London E.C.1.
Head Wrightson design waste heat recovery systems for a variety of industries and uses. One example is the large district heating scheme incorporated by Head Wrightson in the new Nottingham municipal incinerator.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

WASTE MATERIAL DISPOSAL FURNACES

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

WET ARRESTERS

Ambuco Ltd.
Station Road, St. Neots, Huntingdonshire (04807-3461).

Buell Ltd.
George Street Parade, Birmingham, B3 1QQ (021-236-5391).

Dust Control Equipment Ltd.
Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

W. C. Holmes & Co. Ltd.
Turnbridge, Huddersfield HD1 6RB (Huddersfield 22222) Telex 51306.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Midac Dust Control
Bedford Road, Birmingham B11 1AY (021-772-3781).

SF Air Treatment Ltd.
Staines House, 158 High Street, Staines, Middlesex, TWI8 4AR (Staines 57221) Telex 261554.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire (061-928-4242) (*Air Pollution Control Engineers*).

WIRE BRUSHES (TUBE AND SURFACE)

Rotatools (U.K.) Ltd.
Pembroke Works, 43/45 Pembroke Place, Liverpool L3 5PH (051-709-6117)
"Rotatool" products embrace the whole range of manual and mechanical tube cleaning equipment for Tubular Boilers and all makes and design of auxiliary Tubular Plant such as Economisers, Evaporators, Condensers, Air Heaters, etc.

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An advanced Combustion Technology expressly to reduce the industrial fuel oil costs, corrosion and maintenance expense, also air pollution.

ROLFITE is a nitrogenous manganese complex supplied in two forms—OIL SOLUBLE for use with oil-fired furnaces and WATER SOLUBLE for use with solid fuels, incinerators etc.

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"Overmead", Blackberry Road,
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Tel. Dormans Park 297 (0342-87 297)
24 Hour Answering Service.

IUAPPA

Third International

Clean Air Congress

will be held at the

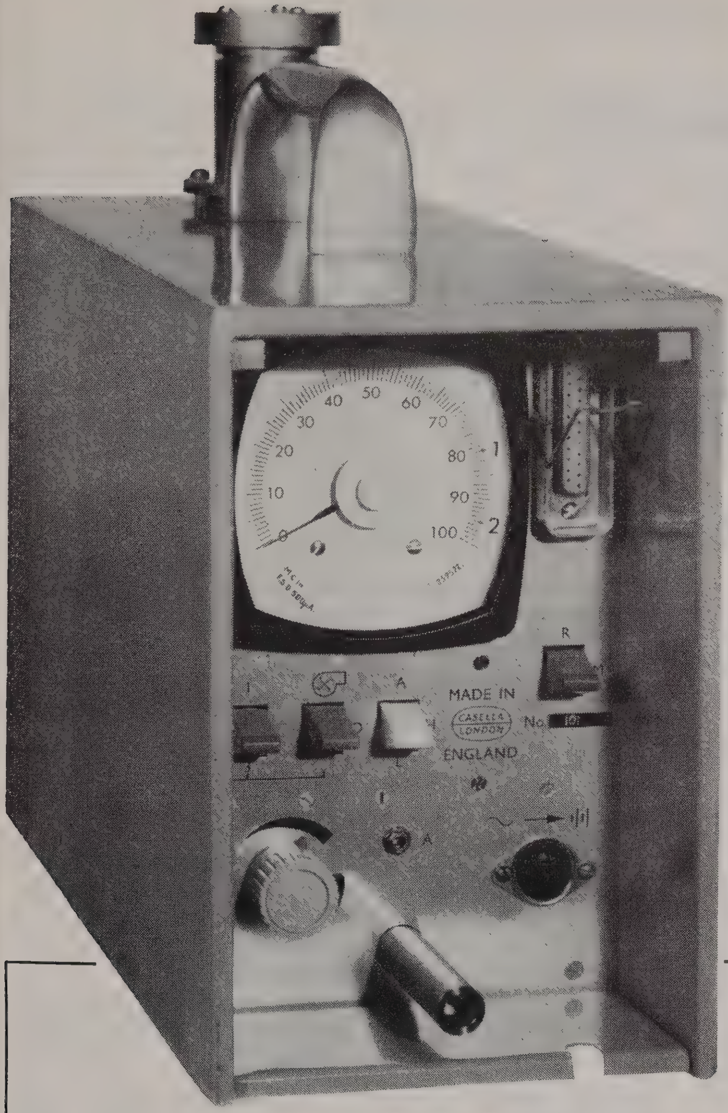
Congress Centre

Neue Messe, Dusseldorf,

West Germany

from

8th - 12th October 1973



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- Wide Range—0.005 to 1000 ppm
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Section 6

NATIONAL SOCIETY FOR CLEAN AIR

134/137 North Street, Brighton BN1 1RG

Telephone: Brighton 26313

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South Wales and Monmouthshire: W. Bate, Ald. J. H. Warren.

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Association of Public Health Inspectors: T. H. Iddison.
British Medical Associaton: Dr. W. C. Turner.
British Steel Corporation: G. E. Speight.
Central Electricity Generating Board: A. J. Clarke.
Electrical Association for Women: Miss M. George.
Electricity Council: R. H. Phillips.
Gas Council: J. A. Prigg.
Industrial Gas Cleaning Association: K. H. Pearson.
Institute of Fuel: B. Lees.
Institute of Petroleum: H. I. Fuller.
Institution of Gas Engineers: Dr. F. A. Burden.
Low Temperature Coal Distillers' Association: Commander C. Buist.
National Coal Board: R. W. C. Wheatley.
Royal Society of Health: E. N. Wakelin.
Solid Smokeless Fuels Federation: H. G. Giblin.
Women's Advisory Council on Solid Fuel: Mrs. J. Saunders.
Women's Gas Federation and Young Homemakers: Mrs. C. Gimpel.

Director and Secretary: Rear Admiral P. G. Sharp, C.B., D.S.C.

Divisional Councils

Scotland: President: Cllr. Mrs. Rina T. Nealon; Hon. Secretary: F. J. Feeley, Town Clerk's Office, 78 Cochrane Street, Glasgow. (041-221 9600, ext. 2538).

Northern Ireland: Chairman: R. Campbell Brown; Hon. Secretary: B. P. Hanna, Belfast Corporation Health Dept., 16 College Street, Belfast BT1 6BX. (Belfast 41771).

North West: Chairman: R. A. W. Hollingdale; Hon. Secretary: W. E. Pollitt, Health Centre, Crescent, Salford. (061-736 5891).

North East: Chairman: Ald. B. N. Young; Hon. Secretary: L. Mair, Civic Centre, Barras Bridge, Newcastle-upon-Tyne. (Newcastle-upon-Tyne 28520).

Yorkshire: Chairman: L. Eastwood; Hon. Secretary: J. H. Wyatt, Health Dept., 12 Market Buildings, Vicar Lane, Leeds 1. (Leeds 30211, ext. 29).

East Midlands: Chairman: H. B. Dunstan; Hon. Secretary: E. F. Raven, Public Health Dept., County Borough of Derby, Castlefields House, Main Centre, Derby DE1 2FL. (Derby 31111).

West Midlands: Chairman: Cllr. H. N. Scrimshaw; Hon. Secretary: F. Reynolds, Public Health Dept., Trafalgar House, Paradise Street, Birmingham B1 2BQ (021-235 3759).

South East: Chairman: W. Combey; Hon. Secretary: R. F. Shapter, Public Health Dept., 8 Easton Street, High Wycombe. (High Wycombe 26100).

South West: Chairman: Ald. G. Hebblethwaite; Hon. Secretary: D. J. Barnett, Chief Public Health Inspectors' Office, Union House, Union Street, Bristol BS1 (0272 26241).

South Wales and Monmouthshire: Chairman: Cllr. Mrs. P. M. Mainwaring; Hon. Secretary: L. Morgan, 9 Lodge Drive, Baglan, Port Talbot. (Port Talbot 5231).

Information about the Society

The forerunners of the Society were the Coal Smoke Abatement Society, established in London in 1899, the Smoke Abatement League of Great Britain (1909) concerned mainly with the Provinces and the National Smoke Abatement Society, formed in 1929 by the amalgamation of the two parent organisations. At a Special General Meeting held in April 1957, it was agreed unanimously to change the name of the Society to "National Society for Clean Air", and to seek incorporation as a company limited by guarantee, a licence being sought from the Board of Trade to omit the word limited. The Society assumed its new name and status as from 1st January, 1958.

For further information about membership, Executive Council and Committees, etc., reference should be made to the Society's Memorandum and Articles of Association and Byelaws.

Divisions

For electoral purposes and where it is desired, area organisation, the Society is now composed of the following geographical Divisions: (1) Scotland, (2) Northern Ireland, (3) North West, (4) North East, (5) Yorkshire, (6) West Midlands, (7) East Midlands, (8) South West, (9) South East, (10) South Wales and Monmouthshire. (See Byelaws for the Counties in each Division.)

Membership and Subscriptions

Membership

The Society is wholly dependent on the contributions of its members for the growth and the maintenance of its work, and invites the support of all who sympathise with and wish to promote its objects. These are stated in full in the Memorandum of Association, but they may be briefly summarised as the securing throughout the United Kingdom of the maximum of natural light and air free from every form of pollution, particularly that arising from the combustion of fuel. There are three main classes of membership—for individuals, local authorities, and corporate bodies such as firms, public undertakings and institutions. Individual members and the representatives of other members have rights of nomination and voting in elections for Officers and Council. They receive, free of charge, the Society's quarterly journal *Clean Air* and other publications.

Corporate members who have branches or offices in Divisions of the Society other than that in which their Registered Office is situated may appoint Delegates to participate in the activities of those Divisions. Members are entitled to receive assistance and information on problems relating to air pollution. In addition to receiving notices of meetings and conferences organised nationally, they are entitled to participate in any activities organised by or within their Division. The Society's Subscription year is for the period 1st April to 31st March.

Associates

Any individual, local authority, institution or corporate body contributing less than the appropriate membership subscription may become an *Associate*, entitled to some of the privileges of membership, but not to those relating to nomination, voting and election to office. The minimum subscription for an Associate Member is £3.

Subscriptions

Individual Members—Not less than three pounds.

Local Authority Members—Not less than the following amounts, according to population, which is taken from the current issue of The Municipal Year Book.

	£
less than 25,000	10
25,001 to 50,000	13
50,001 to 75,000	17
75,001 to 100,000	23
100,001 to 175,000	35
175,001 to 250,000	40
250,001 to 375,000	45
375,001 to 500,000	50

Over 500,000, £15 for each additional 1,000,000 of population or part thereof.

Corporate Members—Not less than forty pounds (four representatives and two delegates in each appropriate Division), or not less than twenty-three pounds (two representatives and one delegate in each appropriate Division).

(Under Article 5 (e) (ii) of the Society's Articles of Association, an Association or firm which is not incorporated can appoint representatives to act on its behalf, and obtain all the benefits of Corporate Membership.)

Sustaining Members—A member in any class subscribing not less than £100 a year.

Special Cases—The Executive Council may consider applications for membership on special terms as to subscriptions and otherwise. This rule is intended to apply in particular to local and other small voluntary associations wishing to become Corporate Members.

Associates—Any sum that is less than the appropriate subscription for membership, but with a minimum of three pounds.

Payment of Subscriptions—The first subscription should be forwarded with application for membership. This may be sent at any time, but will commence from 1st April, and back issues of *Clean Air* will be sent to new members.

It is mutually advantageous if subscriptions are made by Banker's Order.

Donations—The Society will be pleased to receive single or annual donations for any amount from non-members.

Covenant Donations — Annual contributions to the society may be made under covenant, the Society being recognised as a "charity" by the Commissioners of Inland Revenue for this purpose. By signing an agreement to subscribe a stated sum for a minimum of seven years the Society may claim the amount of income tax that has been paid on such contributions, thereby increasing the benefit it receives without additional cost to the donor.

Further particulars and form of covenant will be forwarded on request.

Membership as at 1st October 1972

SCOTTISH DIVISION

Sustaining Members

	£—p
South of Scotland Electricity Board	100.00
The Scottish Gas Board	150.00

Local Authority Members

	£—p
Aberdeen Cpn.	40.00
Airdrie Cpn.	13.00
Ayr Cpn.	5.00
Ayr C.C.	5.00
Barrhead, Burgh of	10.00
Clackmannan C.C.	13.00
Clydebank Cpn.	13.00
Coatbridge Cpn.	17.00
Dumbarton Cpn.	13.00
Dumfries Cpn.	13.00
Dunbarton C.C.	23.00
Dundee Cpn.	40.00
Dunfermline Cpn.	17.00
East Kilbride Cpn.	17.00
Edinburgh Cpn.	50.00
Falkirk Cpn.	13.00
Fife C.C.	35.00
Glasgow Cpn.	65.00
Grangemouth Cpn.	10.00
Hamilton, Burgh of	13.00
Hawick, Burgh of	10.00
Inverness Cpn.	13.00
Irvine, Royal Burgh of	10.00
Johnstone Cpn.	10.00
Kilmarnock, Burgh of	13.00
Kilsyth, Burgh of	10.00
Kircaldy, Royal Burgh of	17.00
Kirkintilloch, Burgh of	10.00
Lanark C.C.	45.00
Motherwell & Wishaw, Burgh of	17.00
Paisley Cpn.	23.00
Perth C.C.	3.15
Perth C.C.	13.00
Port Glasgow Cpn.	3.00
Renfrew C.C.	35.00
Renfrew, Royal Burgh of	10.00
Rothesay, Royal Burgh of	10.00
Rutherglen. Royal Burgh of	13.00
Stirling C.C.	23.00
Stirling. Royal Burgh of	13.00
West Lothian C.C.	35.00

Corporate Members

	£—p
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North of Scotland Hydro Electric Board	23.00
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Scottish Rexco Ltd.	23.00
Smith & Wellstood Ltd.	3.00
Waldie and Cameron Ltd.	3.00

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Christie, J. H.	3.00
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Hally, J.	3.00
Horne, Dr. W. A.	2.10
Hoyle, J. D.	1.50
Innes, J.	3.00
Irvinne, J.	3.00
MacPherson, I.	3.00
Moule, Rev. J. W.	3.00
Potter, G. N.	3.00
Ramsey, Captain E. C.	5.20
Slimming, D. W.	3.00
Snodgrass, G. A.	3.00
Strump, G.	3.00

NORTHERN IRELAND DIVISION

Local Authority Members

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Antrim R.D.C.	13.00
Ballymena Cpn.	10.00
Belfast City	50.00
Carrickfergus Cpn.	10.00
Castlereagh R.D.C.	17.00
Londonderry Cpn.	23.00
Portadown Cpn.	10.00

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Electricity Board for Northern Ireland	23.00
Northern Ireland Electrical Development Association	23.00

Individual Members

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O'Brien, W. E. C.	3.00
Porter, Colonel H. J.	3.00
Reynolds, A.	3.00

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North-Western Electricity Board	101.00
North-Western Gas Board	200.00
Shell Chemicals U.K. Ltd.	125.00
Simon Carves Ltd.	200.00

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Accrington Cpn.	13.00
Altrincham Cpn	13.00
Ashton-in-Makerfield U.D.C.	13.00
Ashton-under-Lyne Cpn.	13.00
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Burnley R.D.C.	10.00
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Lancashire & District Coke Distributors Association	30.00
Macclesfield Civic Society	3.00
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Franklin, N. J.	3.00
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Taylor, Mrs. E.	3.00
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NORTH-EAST DIVISION

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Bedlingtonshire U.D.C.	13.00
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Blaydon U.D.C.	13.00
Boldon U.D.C.	10.00
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Chester-le-Street R.D.C.	13.00
Chester-le-Street U.D.C.	10.00
Consett U.D.C.	13.00
Crook & Willington U.D.C.	10.00
Darlington Cpn.	7.35
Durham R.D.C.	13.00
Felling U.D.C.	13.00
Gateshead Cpn.	35.00
Gosforth U.D.C.	13.00
Hartlepool Cpn.	23.00
Hebburn U.D.C.	10.00
Hetton U.D.C.	10.00
Houghton le Spring U.D.C.	13.00
Jarrow Cpn.	13.00
Lanchester R.D.C.	10.00
Longbenton U.D.C.	17.00
Morpeth Cpn.	10.00
Newburn U.D.C.	13.00
Newcastle upon Tyne Cpn.	40.00
Northumberland C.C.	65.00
Prudhoe U.D.C.	10.00
Ryton U.D.C.	10.00
Seaham U.D.C.	10.00
Sedgefield R.D.C.	13.00
Shildon U.D.C.	10.00
Skelton & Brotton U.D.C.	10.00
South Shields Cpn.	35.00
Spennymoor U.D.C.	10.00
Stanley U.D.C.	13.00
Sunderland	40.00
Teesside Cpn.	50.00
Tynemouth Cpn.	17.00
Wallsend Cpn.	13.00
Washington U.D.C.	10.00
Whickham U.D.C.	13.00
Whitley Bay Cpn.	13.00

Corporate Members

	£—p
American Air Filter (Great Britain) Ltd.	23.00
Head Wrightson & Co. Ltd.	23.00
Newcastle Regional Hospital Board	23.00
North-Eastern Electricity Board	60.00
Northern Gas Board	100.00
Proctor & Gamble Ltd. (Engineering Division)	25.00
University of Newcastle upon Tyne	3.00

Individual Members

Angus, Col. E. G.	3.15
Atkinson, E.	3.00
Atkinson, H.	3.00
Blake, D.	3.00
Calvert, Mrs. M. R.	3.00
Carr, W.	3.00
Chambers, A.	3.00
Eve, M. E.	1.50
Horn, R.	3.00
Isaac, Professor, P. C. G.	3.00
Learmonth, G. S.	3.00
McMullen, A. J.	3.00
Spriggs, Dr. E. A.	3.00
Thomas, D. M. C.	3.00
Walker, A. S.	3.00

YORKSHIRE DIVISION

Sustaining Members

North Eastern Gas Board	100.00
Yorkshire Electricity Board	106.00

Local Authority Members

Adwick-le-Street U.D.C.	10.00
Aireborough U.D.C.	13.00
Barnsley Cpn.	17.00
Batley Cpn.	13.00
Bentley with Arksey U.D.C.	10.00
Bingley U.D.C.	13.00
Bradford Cpn.	45.00
Bridlington Cpn.	13.00
Brighouse Cpn.	13.00
Castleford Cpn.	13.00
Colne Valley U.D.C.	10.00
Conisbrough U.D.C.	10.00
Cudworth U.D.C.	10.00
Darton U.D.C.	10.00
Dearne U.D.C.	13.00
Denby Dale U.D.C.	10.00
Dewsbury C.B.	17.00
Doncaster C.B.	23.00
Doncaster R.D.C.	23.00
Elland U.D.C.	10.00
Halifax Cpn.	23.00
Harrogate Cpn.	17.00
Heckmondwike U.D.C.	10.00
Hemsworth R.D.C.	17.00
Hemsworth U.D.C.	10.00
Hepton R.D.C.	10.00
Holmfirth U.D.C.	10.00
Horbury U.D.C.	10.00
Horsforth U.D.C.	10.00
Hoyland Nether U.D.C.	10.00
Huddersfield Cpn.	35.00
Ilkley U.D.C.	10.00
Keighley Cpn.	3.00
Kingston-upon-Hull Cpn.	45.00
Knottingley U.D.C.	10.00
Leeds Cpn.	65.00
Meltham U.D.C.	10.00
Mexborough U.D.C.	10.00
Mirfield U.D.C.	10.00
Morley Cpn.	13.00
Normanton U.D.C.	10.00
North Riding of Yorkshire C.C.	45.00
Ossett Cpn.	10.00
Otley U.D.C.	10.00
Pontefract Cpn.	13.00
Pudsey Cpn.	13.00
Queensbury & Shelf U.D.C.	10.00
Rawmarsh U.D.C.	10.00
Rotherham Cpn.	23.00
Rothwell U.D.C.	13.00
Royston U.D.C.	10.00
Scarborough Cpn.	13.00

	£—p
Sheffield & District Clean Air Committee	65.00
Shipley U.D.C.	13.00
Skipton U.D.C.	10.00
Sowerby Bridge U.D.C.	3.00
Spenborough Cpn.	13.00
Stanley U.D.C.	10.00
Swinton U.D.C.	10.00
Thorne R.D.C.	13.00
Todmorden Cpn.	10.00
Wakefield Cpn.	17.00
Wakefield R.D.C.	10.00
Wath-upon-Dearne U.D.C.	10.00
Wombwell U.D.C.	10.00
Worsborough U.D.C.	10.00
Wortley R.D.C.	13.00
York Cpn.	5.25

Corporate Members

Barnsley District Coking Co. Ltd.	23.00
Bradford Civic Society	3.00
British Steel Corporation	50.00
Coke Oven Managers' Association	6.00
Holmes, W. C. & Co. Ltd	40.00
John Thurley Ltd.	40.00
North Eastern Coke Distributors Association	18.00
Universal Machinery & Services Ltd.	15.15
West Riding Clean Air Advisory Council	6.00

Individual Members

Armitage, F.	3.00
Bell, T. R. H.	3.00
Brown, G. L.	3.00
Burn, Dr. A. T.	3.00
Crocker, P.	3.00
Etheringham, H.	1.05
Fleming, I.	3.00
Gower, Miss V. L.	3.00
Griffiths, D. P.	1.05
Hackney, E. S.	3.00
Hutton, Dr. K. B.	10.00
Jones, L.	3.00
Jordon, H. H.	3.00
Machen, C.	3.00
Marshall, G. C.	1.25
Miller, Dr. J. E.	4.05
Moore, L.	3.00
Newell, R. A.	3.00
Saword, A. C.	3.00
Saxton, W. T.	3.00
Scarghill, M.	1.50
Sedgwick, A.	3.00
Sewell, Dr. P.	3.00
Sharp, A. I.	3.00
Slater, D. J.	3.00
Tomlinson, E. S.	3.00
Winfield, E. J.	3.00

WEST MIDLAND DIVISION

Sustaining Members

Midlands Electricity Board	107.00
West Midlands Gas Board	210.00

Local Authority Members

	£—p
Aldridge-Brownhills U.D.C.	23.00
Atherstone R.D.C.	13.00
Bedworth U.D.C.	13.00
Birmingham Cpn.	65.00
Burton upon Trent Cpn.	17.00
Cannock R.D.C.	13.00
Cannock U.D.C.	17.00
Coventry Cpn.	45.00
Dudley Cpn.	40.00
Halesowen Cpn.	17.00
Hereford Cpn.	13.00
Kidderminster Cpn.	13.00
Leamington Spa Cpn.	13.00
Meriden R.D.C.	35.00
Newcastle-under-Lyme Cpn.	23.00
Nuneaton Cpn.	17.00
Redditch U.D.C.	13.00
Rugby Cpn.	17.00
Rugeley U.D.C.	10.00
Seisdon R.D.C.	3.00
Solihull Cpn.	35.00
Stafford Cpn.	17.00
Staffordshire C.C.	65.00
Stoke-on-Trent Cpn.	45.00
Stone R.D.C.	10.00
Sutton Coldfield Cpn.	23.00
Tamworth Cpn.	13.00
Walsall Cpn.	40.00
Warley Cpn.	35.00
Warwick R.D.C.	13.00
Warwick Cpn.	10.00
Warwickshire C.C.	18.90
Wellington (Salop) U.D.C.	3.00
West Bromwich Cpn.	35.00
Wolverhampton Cpn.	45.00
Worcester Cpn.	17.00

Corporate Members

Courtaulds Ltd.	23.00
Cradley Boiler Co. Ltd.	23.00
Danks, Edwin & Co. (Oldbury) Ltd.	23.00
Guest, Keen & Nettlefolds Ltd.	50.00
Lodge Cottrell Limited	23.00
Midland Counties Coke Distributors Association	23.00
Midlands Joint Advisory Clean Air Council	12.00
Warwickshire Clean Air Council	40.00
University of Aston-in-Birmingham—Department of Building	23.00

Individual Members

Berry, R. J.	3.00
Busby, H. G. T.	3.00
Cockerham, Dr. R. G.	1.50
Darby, K.	3.00
Darnell, J. R.	1.50
Dickinson, S.	3.00
Dingley, W. L.	3.00
Donaldson, I. J.	3.00
Fletcher, J. P.	3.00
Garner, N. A.	1.50
Gillet, J. A.	3.00
Gittins, M. J.	3.00
Grimmett, P. H. G.	1.50
Hockton, D.	3.00
Knightsbridge, C. R.	3.00
Longley, J. C.	3.00
Lowbridge, H. E. T.	3.00
Orchard, G. W.	3.00
Owen, A. G.	3.00
Reynolds, F.	3.00
Reynolds, K.	3.00
Roberts, R. E. J.	3.00
Scrimshaw, H. N.	3.00
Smart, R. C.	3.00
Steadman, A. T.	3.00
Taylor, Mr. & Mrs. C. B.	3.00

EAST MIDLANDS DIVISION

Sustaining Members

Coalite & Chemical Products Ltd.	500.00
Eastern Electricity Board	112.00
East Midlands Gas Board	200.00

Local Authority Members

	£—p
Alfreton U.D.C.	10.00
Basford R.D.C.	17.00
Beeston & Stapleford U.D.C.	17.00
Belper R.D.C.	10.00
Belper U.D.C.	10.00
Bingham R.D.C.	13.00
Blaby R.D.C.	17.00
Blackwell R.D.C.	13.00
Bolsover U.D.C.	10.00
Boston Cpn.	13.00
Cambridge City	10.00
Carlton U.D.C.	13.00
Chesterfield Cpn.	17.00
Chesterfield R.D.C.	17.00
Clay Cross U.D.C.	10.00
Clowne R.D.C.	10.00
Coalville U.D.C.	13.00
Corby U.D.C.	13.00
Derby Cpn.	40.00
Dronfield U.D.C.	10.00
Eastwood U.D.C.	10.00
Gainsborough U.D.C.	10.00
Glanford Brigg R.D.C.	13.00
Grantham Cpn.	13.00
Grimsby Cpn.	23.00
Heanor U.D.C.	10.00
Hinckley U.D.C.	13.00
Hucknall U.D.C.	13.00
Ilkeston Cpn.	13.00
Ipswich Cpn.	35.00
Irthlingborough U.D.C.	10.00
Kettering Cpn.	13.00
King's Lynn Cpn.	13.00
Kirkby-in-Ashfield U.D.C.	10.00
Leicester Cpn.	45.00
Lincoln City	17.00
Lincoln County Council (Parts of Kesteven)	10.50
Lincoln County Council (Parts of Lindsay)	10.50
Long Eaton U.D.C.	13.00
Loughborough Cpn.	13.00
Mansfield Cpn.	17.00
Mansfield Woodhouse U.D.C.	10.00
Newark Cpn.	10.00
Norwich Cpn.	35.00
Nottinghamshire C.C.	10.50
Old Fletton U.D.C.	10.00
Peterborough Cpn.	17.00
Repton R.D.C.	13.00
Rushden R.D.C.	10.00
Scunthorpe Cpn.	17.00
Southwell R.D.C.	17.00
Staveley U.D.C.	10.00
Sutton-in-Ashfield U.D.C.	13.00
Swadlincote U.D.C.	10.00
Wellingborough U.D.C.	13.00
Welton R.D.C.	10.00
Wisbech Cpn.	10.00
Worksop Cpn.	13.00
Worksop R.D.C.	10.00

Corporate Members

Dust Control Equipment Ltd.	23.00
East Midlands Electricity Board	89.00
Franklin, Charles Ltd.	5.00
Low Temperature Coal Distillers Association	23.00

Individual Members

Allison, G.	2.10
Barnes, A. J.	3.00
Brown, J. A.	3.00
Catlow, J.	3.15
Cooper, S.	3.00
Crowther, Dr. J. S.	1.05
Darby, F. M.	3.00
Davies, Dr. D.	3.00
Dilworth, J.	3.00
Drabble, J. D.	3.00
Dresser, S.	3.00
Ford, G. E.	3.00
Goodfellow, J.	3.00
Grimson, J.	3.00
Harris, T. A.	3.00
Harrop, J. A.	2.00
Hindle, Dr. P. T.	3.00
McDonald, J. D.	3.00
Needham, C. E.	3.00
Pane, R.	3.00
Scopes, F. V.	3.00
Smith, Lt. Col. C. H.	3.00
Turner, Miss H. E.	3.00
Turner, T. Henry	4.00
Wade, A.	3.00
Waring, F. L.	5.25
Weldon, Miss G. M.	3.00
Willison, Mrs. M. E.	3.00
Wright, P. F.	3.00

SOUTH WEST DIVISION

Local Authority Members

	£—p
Bath Cpn.	23.00
Bathoven R.D.C.	3.00
Bridgewater Cpn.	3.00
Bristol Cpn.	50.00
Cheltenham Cpn.	23.00
Dursley R.D.C.	10.00
Gloucester Cpn.	23.00
Keynsham U.D.C.	3.00
Lydney R.D.C.	10.00
Mangotsfield U.D.C.	3.00
Norton Radstock U.D.C.	3.00
Poole Cpn.	35.00
Shepton Mallet R.D.C.	3.00
Sherborne U.D.C.	3.00
Sodbury R.D.C.	4.20
Stroud U.D.C.	10.00
Swindon Cpn.	23.00
Tetbury R.D.C.	3.00
Tewkesbury Cpn.	3.00
Thornbury R.D.C.	13.00
Warmley R.D.C.	10.00
Weston-Super-Mare Cpn.	3.00
West Penwith R.D.C.	10.00
Weymouth & Melcombe Regis Cpn.	13.00

Corporate Members

	£—p
Imperial Tobacco Co. (of G.B. & Ireland) Ltd.	40.00
South Western Electricity Board	50.00
South Western Gas Board	52.50

Individual Members

	£—p
Archard, P.	3.00
Best, J. K.	3.00
Blampied, F. C.	3.00
Cawley, Lady	3.00
Coleham, J. E.	3.00
Crook, S. C.	3.00
Draper, P.	3.00
Emmett, E. E.	3.00
Freeland, Miss E.	3.00
Harris, J.	3.00
Kennedy, J. G.	3.00
Redston, R. V.	3.00
Thomas, L. C.	3.00
Trevillion, Mrs. F.	3.00
Wakely, R. W.	3.00
Wallis, Mrs. E.	3.00
Watkins, E. R.	3.00
Williams, J. R.	3.00
Whiting, G. C.	3.00

SOUTH EAST DIVISION

Sustaining Members

	£—p
British Petroleum Co. Ltd	150.00
British Steel Corporation	750.00
Central Electricity Board	500.00
Coal Merchants Federation of Great Britain	100.00
Eastern Gas Board	100.00
Electricity Council	500.00
Esso Petroleum Company Ltd.	200.00
Gas Council	1,000.00
Greater London Council	170.00
Imperial Chemical Industries Ltd.	100.00
National Carbonising Co. Ltd.	100.00
National Coal Board	1,000.00
North Thames Gas Board	210.00
Shell International Petroleum Co. Ltd.	300.00
Shell-Mex and B.P. Ltd.	300.00
South Eastern Gas Board	210.00

Local Authority Members

	£—p
Amersham R.D.C.	17.00
Aylesbury Cpn.	13.00
Barking, London Borough of	35.00
Barnet, London Borough of	45.00
Basildon U.D.C.	35.00
Bedford Cpn.	17.00
Bedfordshire C.C.	45.00
Bexley, London Borough of	40.00
Bishop's Stortford U.D.C.	10.00
Bletchley U.D.C.	13.00
Bournemouth Cpn.	3.00
Brent, London Borough of	45.00
Brentwood U.D.C.	17.00
Brighton Cpn.	35.00
Bromley, London Borough of	45.00
Bullingham R.D.C.	17.00
Bushey U.D.C.	13.00
Camden, London Borough of	40.00
Chatham Cpn.	17.00
Chertsey U.D.C.	13.00
Chesham U.D.C.	10.00
Cheshunt U.D.C.	13.00
Chigwell U.D.C.	17.00
Colchester Cpn.	23.00
Crawley U.D.C.	17.00
Croydon, London Borough of	10.50
Cuckfield R.D.C.	13.00
Dartford Cpn.	13.00
Dartford R.D.C.	17.00
Dover Cpn.	13.00
Ealing, London Borough of	45.00
Eastbourne Cpn.	17.00
Easthampstead R.D.C.	17.00
Eastleigh Cpn.	13.00
Egham U.D.C.	13.00
Elstree R.D.C.	13.00
Enfield, London Borough of	45.00
Epping & Ongar R.D.C.	13.00
Epsom & Ewell Cpn.	17.00
Esher U.D.C.	17.00
Essex County Council	3.15
Eton R.D.C.	17.00
Farnborough U.D.C.	3.00
Folkestone Cpn.	13.00
Gillingham Cpn.	23.00
Gosport Cpn.	3.00
Gravesend Cpn.	17.00
Greenwich, London Borough of	40.00
Guildford Cpn.	17.00
Guildford R.D.C.	17.00
Hackney, London Borough of	40.00
Hambledon R.D.C.	13.00
Hammersmith, London Borough of	40.00
Harlow U.D.C.	23.00
Harrow, London Borough of	40.00
Hastings Cpn.	17.00
Havant & Waterloo U.D.C.	35.00
Havering, London Borough of	45.00
Hemel Hempstead Cpn.	17.00
High Wycombe Cpn.	17.00
Hillingdon, London Borough of	40.00
Hitchin U.D.C.	13.00
Hoddesdon U.D.C.	10.00
Hounslow, London Borough of	40.00
Islington, London Borough of	40.00
Kensington & Chelsea, London Borough of	3.15
Kent County Council	5.25
Kingston-Upon-Thames, Royal Borough of	35.00
Lambeth, London Borough of	45.00
Leatherhead U.D.C.	3.00
Lewisham, London Borough of	45.00
Littlehampton U.D.C.	3.00
London Cpn.	65.00
Luton C.B.	35.00
Luton R.D.C.	13.00
Maidenhead Cpn.	13.00
Merton, London Borough of	40.00
New Forest R.D.C.	17.00
Newham, London Borough of	5.00
Northfleet U.D.C.	13.00
Oxford Cpn.	35.00
Portsmouth Cpn.	10.50
Reading Cpn.	5.25
Redbridge, London Borough of	40.00
Reigate Cpn.	17.00
Richmond-Upon-Thames, London Borough of	35.00
Rickmansworth U.D.C.	13.00
Rochester Cpn.	17.00
St. Albans Cpn.	17.00
St. Albans R.D.C.	13.00
Sittingbourne & Milton U.D.C.	13.00
Slough Cpn.	23.00
Southampton Cpn.	3.00
Southend-On-Sea Cpn.	3.00
Southwark, London Borough of	45.00
Southwick U.D.C.	10.00
Staines U.D.C.	17.00
Strood R.D.C.	13.00
Sutton, London Borough of	35.00
Thurrock U.D.C.	35.00
Tower Hamlets, London Borough of	35.00
Tunbridge Wells Cpn.	3.00
Walton & Weybridge U.D.C.	17.00
Wandsworth, London Borough of	45.00
Watford Cpn.	23.00
Watford R.D.C.	17.00
Welwyn Garden City U.D.C.	13.00
Westminster Cpn.	40.00
New Windsor, Royal Borough of	13.00
Windsor R.D.C.	10.00
Wolverton U.D.C.	10.00
Worthing Cpn.	3.00
Wycombe R.D.C.	17.00

Corporate Members

	£—p
Ambuco Ltd.	23.00
Asbestos Information Committee	23.00
Association of Public Health Inspectors	23.00
Beacon Village Society	3.00
B.I.C.E.R.I. Ltd.	3.00
British Insulated Calender Cables Ltd.	23.00
British Independent Steel Producers Association	75.00
British Medical Association	23.00
Buckle, G. H. & Partners	23.00
Burmah Oil Trading Ltd.	23.00
Caltex Services Ltd.	23.00
Centri-Spray Ltd.	40.00
Charrington, Gardner Locket & Co. Ltd.	40.00
Chemical Construction (G.B.) Ltd.	23.00
Coal Utilisation Council	40.00
College of Fuel Technology	23.00
Drummond Dust & Fume Extractors Ltd.	5.00
Dust Suppression Ltd.	23.00
Electrical Association for Women	30.00
Federation of British Cremation Authorities	3.00
Flaregas Engineering	30.00
Ford Motor Co. Ltd.	23.00
A. Guiness, Son and Co. (Park Royal) Ltd.	23.00
Harrold Leather Mfg. Co. Ltd.	3.00
Holliday Fellowship Ltd.	3.00
Howden Engineering Ltd.	40.00
Institute of Fuel	40.00
Institution of Gas Engineers	23.00
Institute of Petroleum	40.00
John Zinc Co. Ltd.	23.00
Joy Trading Cpn.	23.00
London Electricity Board	86.00
London Trades Council	3.00
London Transport Board	40.00
Marshall & Parsons Ltd.	6.00
Metal Box Co. Ltd.	23.00
Mobil Oil Co. Ltd.	52.50
Public Road Transport Association	23.00
Radiation Ltd.	40.00
Rickett Cockerell & Co. Ltd.	10.00
Road Haulage Association Ltd.	23.00
Royal Society of Health	23.00
Solid Smokeless Fuels Federation	52.50

	£—p
South Eastern Electricity Board	69.00
Southern Electricity Board	96.00
Southern Gas Board	75.00
Sturtevant Engineering	30.00
Trist, Ronald & Co. Ltd.	23.00
United Kingdom Atomic Energy Authority	23.00
White Drummond & Co. Ltd.	3.00
Women's Advisory Council on Solid Fuel	23.00
Women's Gas Federation	40.00

Individual Members

	£—p
Acworth, Miss E. A.	1.05
Albone, Dr. E. S.	3.00
Armstrong, F. W.	3.00
Barrie, W. L.	5.25
Bartlam, J. N.	3.00
Bastable, N.	3.00
Baver, F. W.	3.00
Beaumont, M.	3.00
Bond, Prof. G. G.	3.00
Bottom, D. W.	3.00
Boult, Sir Adrian C.	4.50
Bradbury-Williams, J. C.	3.00
Bradford, S. G.	3.00
Bradshaw, Mrs. F. W.	3.00
Bradshaw, N. F.	3.00
Brown, A. W.	3.00
Brown, T. J.	3.00
Bryant, Miss P. M.	3.00
Buddeley, Dr. A.	3.00
Buist, Commander C.	10.50
Burridge, I. G.	3.00
Butler, J. W.	3.00
Carter, Dr. J. S.	3.00
Carter, P.	3.00
Chandler, P.	3.00
Chapman, W.	1.50
Chatfield, A. J.	3.00
Chesney, Miss T. R.	1.05
Chivers, D. P.	3.00
Cleverden, Mrs. S.	1.50
Clinch, H. G.	3.00
Coker, W. G.	3.00
Colville, Lt. Com. R. F.	3.00
Combey, W.	3.00
Courtier, G. B.	3.00
Craxford, Dr. S. R.	3.00
Cronk, J. J. T.	1.50
Crosby, A. S. B.	3.00
Cruttenden, Miss F. N.	3.00
Curtis, B.	3.00
Davies, P. M.	3.00
Davies, R. M.	3.00
Davies, E. T. A.	3.00
Daynes, D. A.	3.00
Dimbleby, T. E.	3.00
Dobson, P. F.	3.00
East, R. G.	4.50
Eaton, Dr. F. J.	3.50
Ellis, P. T. A.	3.00
Elsworth, Mrs. F. S.	3.00
Forestor, Dr. C.	1.50
Fowle, Lady Honour C.	Life Member
Fox, Dr. R. H.	3.00
Gandy, Miss R. L.	3.00
Garland, G. E.	3.00
Gavin, M. J.	3.00
Gilbert, E. D.	3.00
Gimpel, Mrs. C.	3.00
Graves, T. G.	3.00
Green, J.	3.00
Greenhead, S.	3.00
Greenwood, Mrs. E. L.	2.10
Grove, Mrs. G. I.	3.00
Hamilton, Dr. P. M.	3.00
Hawksley, P. G. W.	3.00
Hayward, L. M.	3.00
Held, P. E. J.	3.00
Henson, C. G.	3.00
Hickman, Miss V.	3.00
How, M. D.	3.00
Hulme, G. H.	3.00
Hussey, R.	3.00
Ibbetson, Dr. B.	3.00
Jackson, C.	3.00
James, B. W.	3.00
Jellis, F.	3.00
Jones, D. P. G.	3.00
Jones, Dr. L. H. P.	3.00
Jones, W. L.	3.00
Kendall, Dr. J. D.	3.00
Kirkpatrick, D. A.	3.00
Langwell, W. H.	4.50
Laundon, J. R.	1.50
Lax, Mrs. G.	3.00
Laymond, B. A.	3.00
Lee, S. A.	1.50
Lord, D. G.	3.00
Madelin, Sqn. Ldr. I.	0.75
Mason, J. K.	3.00
Matthews, Dr. N. E.	3.00
Medawar, Lady	1.00
Mellins, Mrs. M. H.	3.00
Menuhin, Yehudi	3.00
Miles, S. E.	3.00
Monkhouse, Dr. A. C.	2.20
Mowle, C. R.	3.00
Nelson, Mrs. D.	3.00
Nonhebel, Dr. G.	3.00
Oliver, G. T.	3.00
Parker, Dr. A.	5.25
Parker, Dr. R. A.	2.00
Parry, M.	0.75
Patrick, G. M.	3.00
Pedrick, F.	3.00
Pennington, W. J.	3.00
Phillips, G. H.	3.00
Pinguex, L.	3.00
Poole, Mrs. W. M.	1.50
Potter, Dr. D. C.	1.50
Potter, Dr. N. M.	1.50
Preston, Dr. T. W.	3.00
Rayner, K. F.	3.00
Read, B.	3.00
Rendel, Dr. M. N.	3.00
Renwick, Dr. and Mrs. J.	1.00
Rice, A. P.	3.00
Robinson, Mrs. E.	3.00
Roper, Captain R.	0.53
Rosling, Miss E. M.	3.00
Rundle, L. G.	3.00
Saunders, Mrs. J.	1.50
Scorer, Professor R. S.	3.00
Scot, J.	3.00
Scotson, D. A.	3.00
Seale, R. J.	1.50
Shackcloth, W.	3.00
Shanks, E. C.	3.00
Shelton, S. J.	3.00
Shillito, D. E.	1.50
Silver, O. B.	3.00
Shielson, Mrs. N. M.	3.00
Smith, A. R.	3.00
Smith, Mrs. P.	3.00
Smith, R. C.	3.00
Sowby, Dr. F. D.	3.00
Stephenson, Dr. R. J.	2.00
Stewart, R. E.	3.00
Stoddard, A.	2.00
Stubbs, G. C.	3.00
Tagg, J. R.	3.00
Taylor, A.	3.00
Thomas, F. L.	3.00
Thomas, R. B.	3.00
Thomas, R. F.	3.00
Todd, G. F.	3.00
Train, Dr. D.	3.00
Turner, Dr. W. C.	3.00
Verdin, A.	3.00
Vine, Mr. and Mrs. G. M.	3.00
Des Voex, Mrs. M. F.	5.25
Watson, Professor H. E.	3.00
Wermann, J. C.	3.00
Westbrook, J.	3.00
White, Dr. H. D. J.	3.00
White, Mrs. C. P.	Life Member
Wigan, H. N.	3.00
Woolcott, A. D.	3.00
Woldridge, K. G. W.	3.00
Yarrow, Mr. C.	3.00

SOUTH WALES AND MONMOUTHSHIRE DIVISION

Local Authority Members

	£—p
Abercarn U.D.C.	10.00
Aberdare U.D.C.	13.00
Abertillery U.D.C.	10.00
Barry Cpn.	13.00
Bedwas & Machen U.D.C.	10.00
Bedwelty U.D.C.	13.00
Bridgend U.D.C.	10.00
Caerlon U.D.C.	10.00
Caerphilly U.D.C.	13.00
Cardiff C.B.	45.00
Cardiff R.D.C.	13.00
Cwmbran U.D.C.	13.00
Ebbw Vale U.D.C.	13.00
Gellygaer U.D.C.	13.00
Llanelli Cpn.	13.00
Llanelli R.D.C.	13.00
Llantrisant & Llantwit Fadre R.D.C.	13.00
Magor & St. Mellons R.D.C.	10.00
Merthyr Tydfil Cpn.	17.00
Monmouthshire County Council	45.00
Mountain Ash U.D.C.	13.00
Mynyddislwyn U.D.C.	10.00
Neath Cpn.	13.00
Newport Cpn.	35.00
Penarth U.D.C.	10.00
Pontypool U.D.C.	13.00
Pontypridd U.D.C.	13.00
Port Talbot Cpn.	17.00
Risca U.D.C.	10.00
Swansea Cpn.	35.00
Tredegar U.D.C.	10.00
Ystradgynlais R.D.C.	10.00

Corporate Members

Ambercwmboi Clean Air Committee	3.00
Coal Merchants Federation of Wales	6.00
Coopers Filters Ltd.	10.00
South Wales Electricity Board	53.00
Swansea Port Health Authority	23.00
Wales Coke Distributors Association	18.00
Wales Gas Board	40.00

Individual Members

Brownrigg, M. A.	3.00
Clarke, J. A.	3.00
Harrop-Griffiths, H.	4.00
Harry, T. W.	3.00
Heycock, I. G.	3.00

OVERSEAS DIVISION

Local Authority Members

Durban, Corporation of the City of (South Africa)	50.00
Geleen, Municipality of (Netherlands)	10.00
Johannesburg, City of (South Africa)	20.00
Leichhardt, Municipality of (Australia)	10.50
Newcastle, City of (Australia)	3.00
Vereeniging, Town Council of (South Africa)	3.00

Corporate Members

Hong Kong Electric Co. Ltd.	23.00
New Zealand Clean Air Society	5.00
Public Utilities Board, Electricity Dept. (Singapore)	40.00

Individual Members

	£—p
Anderson, Mrs. P. M. (Australia)	1.05
Bezares, Fernando (Spain)	3.00
Brandt, William G. Jr. (U.S.A.)	$8.00
Brunelle, Mrs. M. F. (U.S.A.)	$8.00
Buschman, C. H. Netherlands)	3.00
Chamberlin, R. L. (U.S.A.)	$8.00
Chantler, P. (Cyprus)	4.20
Cutts, Chisholm (Australia)	3.00
Daly, J. (Dublin)	3.00
Danson, J. (Rhodesia)	3.00
De Coster, J. P. (Belgium)	3.00
De Permentier, Paul R. (Belgium)	3.00
Easterbrook, J. L. (South Africa)	3.00
Eldridge, Gardner S. (Canada)	3.00
English, Dr. Bruce V. (U.S.A.)	$8.00
Feige, H. J. (Israel)	3.00
Ferguson, Dr. A. L. (South Africa)	3.00
First, Professor Melvin W. (U.S.A.)	$8.00
Fitzgerald, J. L. (Ireland)	3.00
Froelicher, Miss F. M. (U.S.A.)	$8.00
Fung, Lawrence (Hong Kong)	3.00
Gerhardsson, Gideon (Sweden)	3.00
Ghionis, A. (Greece)	3.00
Gilpin, A. (Australia)	1.05
Ginger, Roy C. (New Zealand)	3.00
Gladstein, Dr. Tunia M. (Israel)	3.00
Grafe, Dr. Kurt (Germany)	3.00
Griffin, R. (Rhodesia)	3.00
Hasselhuhn Bjorn (Sweden)	3.00
Hewson, Dr. E. Wendell (U.S.A.)	$8.00
Hobbs, R. L. (Australia)	3.00
Hooton, K. A. H. (U.S.A.)	$8.00
Hunigen, Dr.-Ing Edmund (Germany)	3.00
Johnson, K. R. (South Africa)	3.00
Jones, Evans H. (South Africa)	3.00
Jones, Mrs. M. A. (South Africa)	3.00
Kettner, Dr. Helmut (Germany)	3.00
Lordin, H. C. (U.S.A.)	$8.00
Meyerhofer. M. E. A. (Switzerland)	3.00
Missen, R. J. (U.S.A.)	$10.00
Mueller, Dr. Peter K. (U.S.A.)	$8.00
O'Connor, Dr. T. C. (Ireland)	3.00
Pedrero, Dr. Pablo Sanz (Spain)	3.00
Pepperdine, E. C. (Gibraltar)	2.00
Ratnasingam, M. (West Malaysia)	3.00
Rebello, Professor F. P. (Brazil)	3.00
Reif, Dr. A. E. (U.S.A.)	$8.00
Ruff, C. D. (U.S.A.)	$8.00
Ruffner, J. (U.S.A.)	$8.00
Shelley, J. (Dublin)	3.00
Smith, E. M. (U.S.A.)	$8.00
Sordelli, Dr. Danilo (Italy)	3.00
Strach, L. (Germany)	3.00
Taga Takahide (Japan)	3.00
Triffett, A. C. (Australia)	3.00
Wight, Dr. J. Earle (Canada)	3.00
Wise, William (U.S.A.)	3.00

THE INTERNAL COMBUSTION ENGINE AND POLLUTION

Clean Air Spring Seminar, Oxford

Tuesday 3rd and Wednesday 4th April 1973

A residential 2 day seminar will be held in Oxford on the 3rd and 4th April. Technical sessions will be held in Magdalen College School Hall; accommodation and meals will be in St. Hilda's College.

The four technical sessions will deal in turn with the petrol engine, the diesel engine, the jet and gas turbine and a look at the future of the internal combustion engine.

Further details may be obtained from
National Society for Clean Air,
134-136 North Street,
Brighton BN1 1RG,
Tel: Brighton 26313

National Society for Clean Air

ANNUAL REPORT & ACCOUNTS

Year Ending, 31st March 1972

The period under review has proved to be an interesting and productive year for the Society. The increased activity engendered by European Conservation Year 1970 settled down to a real interest in a better environment in which clean air was an extremely important factor. By March 1971 the shortage of solid smokeless fuel, which had resulted in over 500 suspensions of Smoke Control Orders, was begining to be a thing of the past. The manufacturers were able to assure everybody that there was an adequate supply and it was therefore possible for suspensions to be rescinded and for the smoke control programme to get under way once more. This was helped by a circular issued by the Department of the Environment encouraging all local authorities to increase their efforts in this direction, and also by a successful press conference organised by the Society on the 19th August, 1971. These seem to have had a beneficial effect as statistics indicate that the curve has now taken a satisfactory upward trend.

Although the activities of the Society may be said to have followed the usual sequence, no exhibition was held in the period under review; but in March 1972 a very successful technical seminar was held at the Grand Hotel in Manchester. In addition, the Society played a major part in organising an international conference in Milan in conjunction with COMIS, an Italian exhibition firm. The Society also sponsored a Joint Venture Stand with the Department of Trade and Industry at the exhibition in Milan held jointly with the conference.

The curves, both of numbers and of income from membership, are slowly going up. Because of the increase in subscriptions that have taken place over the last 4 years, there have been some resignations and this inevitably resulted in a drop in numbers but with little decrease in financial income. On the other hand, this has been more than made up by an increase in new members, particularly from industry and from individuals.

Annual General Meeting

The Society's Annual General Meeting was held on Tuesday, 22nd June, 1971, and this might be described as a gala occasion. By kindness of the Corporation of the City of London the meeting was held at the historic Guildhall. Beautiful surroundings undoubtedly lent an air of dignity and solemnity to the proceedings, but the beautiful flowers, the glorious gold plate and indeed the very attire of the members—especially that of the ladies—on a glorious summer day added a note of restrained gaiety.

The meeting was well attended and the agenda was dealt with in a business-like and expeditious manner. The Annual Report and Accounts were accepted and then Sir Kenneth Hutchison, C.B.E., F.R.S., the retiring President, invested the new President, Mr. Stanley E. Cohen, C.B.E., C.C., who had been Honorary Treasurer of the Society for the previous 14 years, with the chain of office of President.

The Annual Public Meeting followed the business meeting and this again was very well attended. The Rt. Hon. the Lord Mayor of London, Sir Peter Studd, welcomed those present and the address which followed was given by Lord Molson, the Chairman of the Committee for Environmental Conservation. Both speeches were published in full in the autumn 1971 issue of "Clean Air".

After the Public Meeting, the Corporation of London very kindly entertained the members of the Society and guests to a magnificent buffet luncheon in the Livery Hall and Crypt. Altogether this was a most enjoyable occasion and one which will be long remembered by all those who were fortunate enough to attend.

Annual Conference, Folkestone

The Annual Conference was held at Folkestone from 2nd to 5th November. When it became necessary to alter the date of the Conference from the middle of October, there were some misgivings that this might have an unfortunate effect on attendance and the weather might be, to say the least, inclement. In the event the weather was brilliant until just after the closing session and there were in fact more full-time registrations than in the previous year.

The Mayor of Folkestone, Councillor John Jacques, started the proceedings by welcoming everybody at the Open Session. What was especially pleasing was that he made many of the visitors from abroad welcome in their own language. The Conference was opened by Sir Eric Ashby, F.R.S., the Chairman of the Royal Commission on Environmental Pollution. There is no doubt that Sir Eric's very fine address set the tone for the whole week's proceedings. He left no one in any doubt that there was still much work for the Society to do, but that to do this it would be necessary for the Society to broaden its horizons. Sir Eric's address was published in full in the Winter 1971 issue of "Clean Air" together with the Presidential Address given by Mr. S. E. Cohen, C.B.E., C.C.

There was no Open Session at Folkestone, and the Wednesday afternoon was devoted to technical and social visits and the golf and tennis tournaments. One new departure was the inclusion of a purely social visit for both ladies and gentlemen to Canterbury. That this proved popular was shown by the fact that over 90 people enjoyed an afternoon at Canterbury Cathedral followed by tea at the County Hotel, even though there was a scare that a bomb had been placed in the crypt of the Cathedral just before the party had left.

The papers presented at the Conference were of a high order and certainly moved out into new fields. The interest displayed by delegates was marked and all sessions, including the last session on the Friday morning, were very well attended and discussion was lively. Various visual and audio aids were employed; at the Thursday afternoon session there were no less than two film projectors, one slide projector, two tape recorders, one amplifier, one extra loudspeaker and the public address system in use more or less at the same time.

Clean Air Spring Seminar

The first Clean Air Spring Seminar was held at the Grand Hotel, Manchester on the 22nd and 23rd March 1972.

The Seminar was opened by the Lord Mayor of Manchester, Alderman D. J. Edwards, at 9.30 on the Tuesday morning and within a quarter of an hour the first technical session was under way. The first session dealt with the disposal of wastes and Mr. Neil Iliff, C.B.E., a member of the Royal Commission on Environmental Pollution, certainly got the Seminar off to a very good start. The session on the Wednesday afternoon was concerned with the working environment; that on the Thursday morning considered dust and gaseous pollutants and this proved to be a very lively session indeed. The closing session on the Thursday afternoon considered furnaces and chimneys.

The Seminar was attended by over 170 delegates and served to indicate that there is a definite requirement for technical seminars or symposia of this nature. A further seminar for Spring 1973 is planned to be held in Oxford and this may well set the pattern for future events.

Antinquinamento '71 Milan

Early in 1970 the Society was approached by Lintex Limited and N.I.F.E.S. with a request to organise an international conference on pollution in Milan in 1971. After considerable negotiations it was agreed that the Society would go ahead with the project provided that all expenses were guaranteed and that any profit from the conference should come to the Society. Early in 1971 Lintex Limited came to an agreement with COMIS of Milan and the conference was arranged for November 1971. This left very little time to collect together the necessary speakers on all types of pollution from many different countries, especially as the postal strike was on at the time. However, a programme was arranged and although great difficulty was experienced in obtaining manuscripts of their papers from the Italian authors, the Conference took place as planned.

The Conference was opened by Professor L. Petrilli, the Director of the Institute of Hygiene at the University of Genoa, who gave a very stirring address on global pollution and its effects on human health. The Monday afternoon was given over to the exhibitors for presentation of short papers on their products. On the Tuesday, the technical conference really got under way with both morning and afternoon sessions being utilised for "scene setting" in which speakers reviewed the conditions pertaining in their own countries in Europe. The session on Wednesday morning dealt with pollution of the land and in the afternoon noise was considered.

On the Thursday morning water pollution was discussed and in the afternoon air pollution and its control was the subject. Papers were given by Mr. F. E. Ireland, Her Majesty's Chief Alkali Inspector, Mr. A. Sverdrup of Norway, Mr. L. Angyan of Hungary, Ing. L. Erizzo, Ing. L. Rigutini, Professor M. Colombini and Professor E. de F. Frangipane of Italy. These sessions on water and air turned out to be the most popular; they were the best attended and aroused the most interest. On the Friday morning, under the Chairmanship of Sir Kenneth Hutchison, the Immediate Past President of the Society, pollution of the sea was discussed. This was followed by the closing session which took the form of general discussion under the Chairmanship of Professor G. A. Canaperia of Rome who was the overall President of the conference. This proved a most interesting session in which pollution was considered right across the board in all its forms, internationally. The conference was a worthwhile venture and it enjoyed success.

The exhibition which accompanied the conference, was of a truly international character and was held at the Milan Fair. The British Joint Venture Stand, which was organised by the Society in conjunction with the Department of Trade and Industry, attracted a great deal of attention. The exhibitors who participated were F. E. Beaumont Ltd., The British Consultants Bureau, Effluent Control International Ltd., Fleming Instruments Ltd., Glass Developments Ltd., Satec Ltd., Steam Vacuum Extraction Ltd., Tilghman Wheelabrator Ltd. and Warren Spring Laboratory; the Society also had an information stand. All exhibitors were well patronised and all considered that they had a successful time at the exhibition. The Society's stand received many enquiries on air pollution and our literature was in great demand.

Motor Vehicle Testing

During 1971, the Society in its campaign against pollution of the air by road vehicles, carried out a series of tests to measure the carbon monoxide content of vehicle exhausts. By holding these tests the Society endeavoured to show members of the public not only how their vehicles were polluting the air but also how such pollution could be reduced.

The tests started in July when the Society with the co-operation of the Brighton Health Department and the Sussex Constabulary organised tests on Brighton seafront using the Sieger Exhaust Gas Analyser. At Brighton 373 cars were tested; only 86 of these registered 4·5% or under of carbon monoxide. 84 cars registered over 10%.

In October, the Society went to the City of London. There, helped by the City of London Health Department and the City of London Police, similar tests were carried out in Queen Victoria Street, using the Honeywell Combustion Analyser.

A random selection of 129 cars were tested and the results achieved were very similar to those obtained in Brighton.

In March 1972, tests were carried out at the Artillery Grounds in Bristol. This time the instrument used was the Mexa 300 Carbon Monoxide/Hydrocarbon Analyser marketed in this country by T.E.M. Sales Ltd. Again the results followed a similar pattern.

At all three places it was found that drivers were very co-operative and many were anxious for more information on how to reduce exhaust emissions from their cars. These tests have proved a very successful project and further ones during the current year are planned for Birmingham and Newcastle-upon-Tyne.

The Council and Committees

The Council and its Committees met regularly during the year. At its first meeting, the Council elected Mr. S. Cayton, M.B.E., C.Eng., M.Inst.F., as Chairman.

Opportunity was taken early in the period under review to combine the Conference Committee with the Publicity Committee. This new Committee has had a very busy year in preparing the programmes for the conferences at Milan and Folkestone and for the Spring Seminar in Manchester. It has also been concerned with looking at the future and in making preliminary arrangements for the forthcoming Conference at Scarborough and the Spring Seminar to be held in 1973.

The Technical Committee has had a very busy year; it has been concerned very much with the tests carried out on motor vehicles in various parts of the country and was also very fully occupied with re-writing the Society's pamphlet on Sulphur Dioxide. This pamphlet was published in October and a full report on it was presented at the Folkestone Conference.

The Parliamentary and Local Government Committee, following the shortage of solid smokeless fuel at the beginning of 1971, have been very concerned with efforts to resuscitate the smoke control programme throughout the country.

The General Purposes and Finance Committee has been busily engaged on the important work of the finance and management of the Society. As well as the day-to-day management of affairs, the Committee has also been engaged in the implementation of proposals put forward by the Steering Committee for the re-structuring and streamlining of the Council and its Committees. This evolutionary process can only be gradual and will inevitably take some time. Some minor changes have already been made; other changes will take longer; and some will be influenced by the final outcome of the Local Government Bill.

It does now seem that as a result of efforts made during the last 12 months, the downward trend in our finances over the past few years has been checked. It has been possible to effect economies and to put things on a stable footing which promises well for the future. Although some of the capital expended earlier was to cover the cost of moving to Brighton, there is no doubt that this move has proved successful from financial as well as from other aspects. At the same time the Society, like everyone else, is at the mercy of inflation and any increase in prices, especially so far as printing is concerned. It will therefore be necessary to keep subscriptions constantly under review in order to keep up with expenditure. Over the last 4 years and in the last 12 months in particular the response from members has been good, and that from industry has been especially so.

The Divisions

Reports published throughout the year in "Clean Air" have shown that the Divisions have continued to be active.

Some Divisions have arranged public meetings in conjunctions with their other activities. These have proved successful and this would seem to indicate a pattern for future activities. It is hoped that this trend will continue. In the period under review, the Chairman of the Council has attended the Annual General Meetings of four Divisions. This is putting into effect the intention he expressed on taking office of "getting round the Divisions".

Publicity and Public Relations

The past year has been a good one for the Society in terms of the publicity it has received. This was undoubtedly due to the increased number of activities that have been undertaken by the Society, in particular the testing of road vehicles in which great interest was shown by national television and radio and the press. The Folkestone Conference received a very good press; Milan was well reported, especially on the Continent, and the Spring Seminar also received its fair share of publicity.

Requests for assistance from the library and information department have continued throughout the year at a very high level from the press, radio, television, schools and industry and on an international scale. There has been a marked increase in requests for information from students and school children.

The staff and members of the Society have taken part in radio and television programmes broadcast in this country and throughout the world. In addition, a large number of speaking engagements have been fulfilled throughout the country.

During the period under review, the sale of the Society's publications has shown an increase of some 30% over that of the previous year.

In September 1971 the Society had a stand at the Dust Control Exhibition at Olympia. This created a great deal of interest and resulted in increased membership and a fillip to the sale of the Society's publications.

Involvement with Government and Other Agencies

The Society is becoming more involved with clean air at government and other similar levels. We are well represented on the Clean Air Council by the President, Mr. S. E. Cohen, Commander C. Buist, Mr. T. H. Iddison, Professor R. S. Scorer and the Director. Messrs. S. Cayton and A. C. Saword are members of the Department of the Environment's Working Party on the Suppression of Odours from Offensive and Similar Trades. Messrs. W. Bate and F. Reynolds are members of the Department of the Environment's Working Party on Grit and Dust Emissions from Combustion Processes. Mr. Philip Draper is a member of the appropriate Committee of the British Standards Institute which deals with exhausts from diesel engined vehicles; the Director is also a member of Committees at the British Standards Institution and has also served as a member of Sir Eric Ashby's Working Party on Pollution to prepare the report to be presented at the forthcoming United Nations Conference at Stockholm.

The Society has a good presence at the Standing Conference of Cooperating Bodies (Investigation of Air Pollution) of the Department of Trade and Industry (Warren Spring Laboratory). At the beginning of 1971, Mr. S. Cayton was the Chairman of the Conference: he was succeeded in the middle of the year by Councillor H. N. Scrimshaw, the Deputy Chairman of the Society's West Midlands Division. Other Society members of the conference included Messrs. F. Reynolds, W. Bate, R. F. Shapter, A. W. Perry, W. E. Pollitt, Dr. W. C. Turner, Professor R. S. Scorer, Mr. L. Mair, Alderman A. L. Robinson, Messrs. J. W. Batey, W. L. Kay and T. Henry Turner, Dr. A. Parker and the Director.

Staff

Mr. Eric Hughes, the Publicity Officer and Exhibition Manager, left the service of the Society in May 1971. It was decided not to replace Mr. Hughes but to contract out to exhibition companies any further exhibitions which the Society might stage. As a result of this change it has been possible to streamline the existing staff and re-allocate duties.

The staff now consists of the Director, Mr. P. J. Mitchell as Office Manager, Mrs. Christine Smith as Librarian and Information Officer, Mrs. Suzanne Martin as Assistant Editor and Advertising Officer, Miss Patricia Robson as Personal Assistant and Secretary to the Director, Mrs. Carol Farrow on clerical and accountancy duties and Miss Vanessa John on clerical and secretarial work. This streamlining of the staff and re-allocating of duties has resulted in a much better work-load all round and has enabled the Society to make considerable reductions in expenditure on salaries.

Conclusion and Prospect

As the report above shows, this has been an extremely busy year for the Society. More work has been undertaken by a smaller staff and it has been possible to consolidate the

Society's position and finances. There has been increased activity in the Divisions themselves and this activity shows every sign of continuing in the future with even greater impetus. Nevertheless, in common with other similar bodies, the Society is at the mercy of inflation and rising costs call for constant vigilance. Although, as has been said, membership is slowly increasing, all our members are once again urged to do all that they can to increase membership, particularly from industry and amongst individuals.

The future of the Society depends on the services it can provide for industry and for individuals. This may be by bringing together manufacturers and buyers of plant, equipment or instruments for measuring pollution in joint ventures in one form or another. Alternatively, it may be by providing a forum for the dissemination of information concerning advanced or original research directed towards the reduction of pollution in any form, wherever it can be identified.

The Society's interests are thus widely spread over the total environment. Having laid the foundations of a strong technical organisation and strengthened our financial resources we are well equipped to go forward and take advantage of the opportunities that the future undoubtedly offers.

This year has been an important one in the progress and development of our operations and the demands imposed upon the Director and all our staff have been heavy. My colleagues and I would like to express to them our especial gratitude.

S. CAYTON
Chairman

THE NATIONAL SOCIETY FOR CLEAN AIR

(Company Limited by Guarantee—Incorporated 1st January, 1958)

BALANCE SHEET AS AT 31ST MARCH, 1972

1971 £	*1971* £		£	£	£
		FIXED ASSETS (See Notes to Accounts)			
		INVESTMENTS AT COST			
		Fixed Interest Stocks		3,270	
		Ordinary Shares		9,253	
	12,523				12,523
		CURRENT ASSETS			
600		Stock of Publications at Director's Valuation		600	
7,477		Sundry Debtors and Prepayments		2,820	
58		Bank Balances—Deposit Account	117		
		Current Account	507		
				624	
171		Cash in Hand		38	
8,306				4,082	
		CURRENT LIABILITIES			
8,235		Sundry Creditors and Accrued Expenses	4,247		
4,032		Bank Overdraft	—		
12,267				4,247	
	(3,961)	NET CURRENT ASSETS			(165)
	£8,562	NET ASSETS			£12,358
		Represented by:			
		GENERAL FUND			
10,328		Balance at 1st April, 1971		8,510	
1,099		Profit on Sale of Investments		—	
11,427				8,510	
(2,917)		Profit for the year		3,770	
	8,510				12,280
		PREMISES RESERVE FUND			
		Balance at 1st April, 1971		52	
		Excess Removal Expenses, written back		26	
	52			—	78
	£8,562				£12,358

W. C. TURNER *Honorary Treasurer*
P. G. SHARP *Director & Secretary*

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1972

£	1971 £		£	£
		INCOME		
	16,239	Subscriptions and Donations		20,853
		CONFERENCE		
7,240		Income	8,000	
4,066		*Less* Expenses	2,979	
	3,174			5,021
		EXHIBITIONS		
10,053		Income	—	
8,682		*Less* Expenses (under-provision re previous years)	1,131	
	1,371			(1,131)
		MANCHESTER SPRING SEMINAR		
		Income	3,313	
		Less Expenses	2,471	
	—			842
		MILAN, 1971 CONFERENCE		
		Income	2,458	
		Less Expenses	1,711	
	—			747
		MILAN, JOINT VENTURE		
		Income	1,725	
		Less Expenses	1,514	
	—			211
	1,806	Sales of Publications		2,427
		INVESTMENT INCOME		
1,075		Taxed Dividends (Net)	814	
240		Income Tax Repayments	159	
103		Bank Deposit Interest	59	
	1,418			1,032
	£24,008			£30,002
		EXPENSES		
		Running Costs		
12,975		Salaries and Wages	12,107	
799		Staff Pension Scheme	443	
1,710		Rent, Rates, Light and Heat	1,554	
3,455		Insurance, Travel, Cleaning and General Expenses	3,610	
772		Office Equipment and Furniture	449	
950		Stationery Supplies	773	
60		Bank Interest Paid	58	
20,721			18,994	
		CLEAN AIR AND YEAR BOOK		
4,801		Printing, Postage, etc.	6,585	
2,759		*Less* Advertising Receipts	2,457	
2,042			4,128	
3,055		Information, Publicity Services, and Cost of Publications	2,881	
561		Divisional Grants	228	
546		Dusseldorf, Joint Venture	—	
	26,925			26,231
	£(2,917)	Excess of Income over Expenditure transferred to General Fund		£3,771

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 1972

1. *Lease:*

   The Society bought the lease of its Brighton offices which is for 14 years from 15th November, 1965 and the cost of £2,000 was deducted from the Premises Reserve Fund.

2. *Office Furniture and Equipment:*

   Records are not available to show the original cost price of all Furniture and Equipment.

3. *Investments:*

   The market value of the Society's Investments as at 31st March, 1972 was £21,658: compared to £14,572 as at 31st March, 1971 an increase of £7,086.

4. *Claims against the Society:*

   Two Claims which total £1,858 have been made against the Society. These Claims are disputed and no provision has been made for them in the Accounts.

5. *Profit on Exhibitions etc.:*
The Expenses deducted from the Income do not include Salaries and General Expenses.

6. *Commitments:*
The Society was at 31st March, 1972 committed to:
(a) The purchase of equipment for £2,000.
(b) The publication of two issues of "Clean Air" at an approximate cost of £1,800.

7. *Divisions:*
The ten Divisions of the Society hold small balances for local administration purposes which are not brought into these Accounts.

REPORT OF THE HONORARY AUDITORS OF THE NATIONAL SOCIETY FOR CLEAN AIR

We have examined the Balance Sheet and annexed Income and Expenditure Account. In our opinion the Accounts comply with the Companies Acts 1948 and 1967 and give a true and fair view of the state of the Society's affairs at 31st March, 1972 and of its surplus for the year ended on that date.

33, Furnival Street,
London, EC4A 1JQ

Geo. Little, Sebire & Co.,
Chartered Accountants

1st May 1972

The 40th Annual

CLEAN AIR CONFERENCE

will be held in

TORQUAY

from

15th-19th October 1973

Further details may be obtained from:

National Society for Clean Air
134-136 North Street
Brighton BN1 1RG
Telephone: Brighton 26313

Divisional Reports

South East Division

The 17th Annual General Meeting of the Division was held on 17th November, 1971.

The Chairman Mr. W. Combey paid tribute to the work and interest of Mrs. M. E. Willison who was shortly to retire and leave the Division. Mrs. Willison had been a member of the Divisional Council for many years and had regularly attended meetings. It was with regret that the resignation, through ill health, of Mr. H. G. Cripps of the London Borough of Sutton was accepted, as was that of Mr. Cockell, as Auditor, due to retirement. Both had been long standing members of the Divisional Council.

After the business of the Annual General Meeting, Professor Scorer gave a talk, illustrated by slides, the topic being "A New Look at the Clean Air Act — Its Relation to the Weather." This talk has already been summarised in the Spring 1972 edition of Clean Air.

On May 10th a visit was made to the G.L.C.'s refuse incinerator at Edmonton and 32 persons were given a tour of the works which was arranged by Mr. P. K. Patrick, the General Manager. The visit had been postponed from an earlier date in order that the plant would be fully operative but the date proved to be an unfortunate one because the plant was not working due to a mechanical breakdown. Nevertheless those present were able to see the enormity of the project and be given some statistical information by the guides; that the 80 ft. deep by 40 ft. square bunkers had a capacity of 3,900 tons; that to provide tolerable working conditions within the plant fans of 48,000 cu. ft. per minute capacity were installed on a high floor above the cranes, and that there were usually four furnaces in operation each dealing with 14 tons of refuse per hour. The party also saw the methods of dealing with residual clinker and the precipitators for fly ash. Although the site lay within the Lee Valley Regional Park the incinerator it seemed was acceptable from the planning point of view with adequate tree screening and landscaping.

The Divisional Council met on several occasions and have recently been considering the questions of Nuisances from Garden Bonfires and the Burning of Materials on Demolition Sites, in the latter case a letter was sent to all authorities in Greater London as well as to some of the large County Boroughs outside London, asking for information on any difficulties encountered and replies were received from almost all the Public Health Inspectors contacted.

Conclusions were reached that nuisance from bonfires was one that could be dealt with locally but in the case of building sites representation should be made for a strengthening of legislation to prohibit all " demolition bonfires at or about the site."

The question of Smoke Control by those Authorities which had not yet undertaken a smoke control programme was considered and in this respect a letter and questionnaire was sent to all "defaulting" authorities. 199 questionnaires were sent out and 148 replies were received. This was considered to be very satisfactory and thanks are due to those officers who took the trouble to reply. In general it appeared that Smoke Control was not being carried out for the reasons that (a) there was rapid growth of areas, (b) general conversion of fireplaces by householders without grant aid and (c) in small areas of housing in rural authorities smoke control was unnecessary. On the other hand cost, predominance of local industrial pollution, and apathy had no bearing on the matter. A report on the findings and action to be taken is under consideration by the Division.

On the question of Clean Air Weeks, after full consideration the Executive Council considered that no useful purpose would be served by organising them, but instead recommended that open meetings should be held from time to time, when any person interested in Clean Air could attend.

R. F. SHAPTER,
Hon. Secretary

South Wales Division

A meeting of the Division was held at the Afan Lido, Port Talbot, on Tuesday, 1st August, 1972.

The Chairman — Councillor Mrs. P. M. Mainwaring introduced the Mayor of Port Talbot — Alderman James H. Warren, who extended a civic welcome to Members.

The Meeting was addressed by Rear Admiral P.G. Sharp —Director of the Society, who spoke on the reorganisation and the future role of the Society. In his talk he asked, should we as members look to broadening the Societies outlook in the field of environmental pollution. Many members spoke, supporting this opinion.

Following lunch at the Afan Lido, Members made a visit to B.P. (International) Limited. A welcome on behalf of the Company was extended by Mr. Rod Rees and Dr. Rowland Jenkins.

After touring the works, with a special interest being taken in the new 'multi purpose incinerator' members were entertained to afternoon tea by kind invitation of the Company.

L. MORGAN,
Hon. Secretary.

North West Division

The Annual General Meeting of the North West Division was held at the Pembroke Hall, Worsley, Lancashire on Tuesday, 30th March, 1971. The North West Electricity Board organised an exhibition of heating appliances and the following interesting papers were given. "Space and Water Heating in existing Homes"—by Mr. F. Holland. "Space and Water Heating in new Homes"—by Mr. T. Potts. "Air Conditioning and Improved Internal Environment" by Mr. H. Chippendale.

The speakers were introduced to the members of the division by Mr. C. J. George, Commercial Manager of the N.W.E.B. Members of the division were entertained to cocktails and luncheon by the N.W.E.B. and welcomed to the Meeting by Mr. J. Richardson, Chairman of the N.W.E.B.

The divisional council met on four occasions during the year and at the first meeting Mr. R. A. W. Hollingdale, of the N.W.G.B. was elected Chairman of the divisional council and Mr. Lydiate of the solid fuel merchant association was appointed vice-chairman. Mr. H. Cluskie, Chief Public Health Inspector for Leigh, was elected Hon. Treasurer, Mr. Pollitt of Salford was elected Hon. Secretary. However, during the year, Mr. Lydiate changed his employment and was no longer eligible to retain his appointment of vice-chairman of the North West Division. Mr. L. Goodman of the National Coal Board was elected in his place as vice-chairman for the remainder of the year.

The work of the North West Division during the year has concerned itself with Local Government Re-organisation and its effect on the National Society for Clean Air. The Director of the Society was invited to a meeting with the national executive members of the North West Division to explain to the members, reasons for re-organisations of the Society. The views of the North West Divisional Council were that there should be no re-organisation of the Society until such time as local government reorganisation took place; this view was upheld by the Executive Council.

A report of the Technical Committee of the National Society for Clean Air on sulphur dioxide was also considered during the year and is still under review. Visits to Robinson Willey of Liverpool and Messrs. Glynwed of Audenshaw, Manchester, were made by members of the division where they had the opportunity of listening to the technical members of these firms and observing the construction and assembly of gas fire appliances, both these firms entertained the members to lunch.

The provision of speakers to various organisations, i.e. school children, womens' guilds, rotary clubs, church guilds were made during the year. It is interesting to note the general interest with which speakers on pollution are received. it would appear that the general public are now acutely aware of the increasing problem of pollution, whether it be smoke, sulphur or noise.

This was a quiet year generally with the unfortunate occurence of the coal strike in the mining industry during the winter. Let us hope that the ensuing year will bring more progress so that smoke control areas and the adjoining authorities will now begin to link up and make a continuous area of smoke control.

It is also hoped that all Local Authorities, particularly those where little progress has been made since the commencement of the Clean Air Act of 1956 will now move a little quicker and reduce the emission of smoke and sulphur dioxide into the atmosphere so we may all breathe cleaner air.

W. E. POLLITT,
Hon. Secretary

Yorkshire Division

During the year there have been 7 meetings of the Divisional Council and 2 open meetings including the Annual General Meeting. It was decided to form a small steering committee from the members of the Divisional Council consisting of representatives from the various Fuel Industries and Local Government in order to assist the Society in producing a programme for the year. Two special and ad hoc sub-committees were appointed to meet on one occasion each to consider the proposal of the Executive Council of the Society on "Reform of Local Government" and to consider what action should be taken in order to encourage laggard authorities in the field of clean air.

The first meeting, on 26th January 1971, of the Yorkshire Division was an Open Meeting held at the kind invitation of Shell-Mex and B.P. Ltd. The 92 members attending heard a paper by Mr. J. A. Nowill, Senior Industrial Fuels Sales Engineer of the Industrial Markets Division of Shell-Mex and B.P. Ltd., on "The oil industry's contribution to the prevention of pollution". Mr. Nowill's talk was followed by two short films "Shadow of Progress" and "Fuel for the 70's".

The Annual General Meeting of the Yorkshire Division was held in the Council Chamber of the Civic Hall, Leeds on 31st March 1971. 82 members and representatives of the Local Authorities attended and after the formal business those present heard an address by the Director of the Society on "The Future Aims of the National Society for Clean Air". Following this two short talks were given on "Solid Smokeless Fuel Supplies in Yorkshire — the immediate position and future prospects" by Mr. J. Menheneott, Regional Marketing Director, Yorkshire Sales Region, National Coal Board and Mr. P. J. D. Cooper, President of the Yorkshire Federation of Coal Merchants Association. The subject was topical in view of the difficulties with solid fuel supplies which has applied during the winter and a spirited discussion from the floor ensued.

The Divisional Council met by invitation of the Coal Products Division of the National Coal Board at the Roomheat Plant at Armthorpe, Nr. Doncaster on 15th June, 1971. The members were conducted round the works where the various processes involved in the manufacture of Roomheat were demonstrated to them. Following the tour technical points about the processes were explained in more detail and an opportunity was afforded to members to raise points of clarification.

Prior to the tour a business meeting of the Divisional Council was held. Members discussed particularly the revised circular No. 32/71 which raised the maximum grant payable upon appliances to be installed in smoke control areas. A discussion was also held upon the use of L.P.G. in motor vehicles. Comment was made upon a proposal to enforce the use of low sulphur content fuels within the London area. Members thought that the proposal, if implemented, ought to deal with the industrial areas of the Midlands and the North rather than the London area.

The Division visited by invitation of Shell-Mex and B.P. Ltd. the Teesport Refinery on 7th September 1971 where the members of the Yorkshire Division and also four members of the North East Division of the Society were entertained and subsequently conducted round the refinery. The main object of the visit was to observe the methods used to prevent pollution of both air and water by the processes carried out.

The Divisional Council met by the invitation of the Yorkshire Electricity Board at their new offices in Leeds on 16th November 1971 to inspect a new office block which had been constructed to a totally intergrated environmental design with no separate heating plant and which relies mainly on light, human occupation and other incidental heating gains for heating purposes. An explanation of the principles involved in the design of a building of this type was given to the members prior to a tour of the offices. On a cold day it was noted that the offices had a very comfortable level of warmth and an attractive environment for the employees.

At the business meeting which preceded the visit members discussed a letter from the Director about smoke control in laggard authorities. It was decided that a sub-committee be formed to consider what could be done to persuade laggard authorities to take action in this sphere.

On the 8th February 1972 the Divisional Council visited the newly established training college for the North Eastern Gas Board to inspect the centralised training facilities for their employees and to see the arrangements for planning gas board operations in the Leeds area.

J. H. WYATT
Hon. Secretary

North East Division

During 1971 the Annual General Meeting of the North East Division was held in Gosforth Park in Newcastle upon Tyne. On this occasion the North Eastern Electricity Board acted as hosts and after inspecting an exhibition described as "Electricity and Clean Air" delegates listened to an illustrated address on "The Development of Domestic Appliances" with special reference to their clean air application. Later in the day members were divided into parties and conducted on a very informative tour of a Testing Station of the North Eastern Electricity Board where they were demonstrated the operations and techniques employed in the testing of electricity meters, the reconditioning and testing of single phase meters and time switches and the use of ultrasonic cleaning methods. An interesting feature of the building was the achievement of an optimum internal environment, irrespective of external atmospheric influences by minimising both heat loss and heat gain and thus creating a more or less permanently satisfactory internal climate.

The Autumn Meeting of the Division was held in October in Gateshead and on this occasion the principal theme was "The Activities of the Oil Industry and the Reduction of Pollution" promoted under the auspices of the sales division of Shell-Mex and B.P. Limited. The proceedings included a number of new films dealing with aspects of world-wide pollution abatement.

At both the above meetings two major factors under discussion was the position of laggard Authorities in relation to smoke control progress and the question of the constitution of Divisional Councils.

With regard to smoke control progress the Chairman had at both meetings drawn attention to the poor record of the North East, and the fact that at the time of the Gateshead Meeting only 31% of the "black area" premises in the region had been covered by operative Smoke Control Orders compared with a national average of over 60% and with the enviable achievement of more than 80% in the London area. This lack of progress in certain regions of the country had earlier during the year attracted the attention of the Executive Council and the Parliamentary and Local Government Committee of the Society arising out of which Divisional Secretaries were asked to take measures to urge authorities in their division to greater efforts.

Such steps were taken in this Division in November 1971 and whilst the appeal was received sympathetically and whilst the attitude of the Society was approved "in principle" it seemed at the end of the year that the traditional adherence to coal as a domestic fuel was continuing to be difficult to overcome. However, there were signs at the end of the year that this unhappy situation of apathy and laggardness in the North East was not going unnoticed at higher levels in Government circles and it is hoped that during the year to come some form of salutary action will be taken to make certain North East Authorities more aware of their civic duties.

The new constitution of the Divisional Council was prepared during the year and was subsequently approved by the Executive Council. Doubts had been expressed at the October Meeting about the usefulness of introducing at this stage a new constitution in view of the impending Local Government Reorganisation and it was decided that, after the general approval of the Executive Council had been obtained, the matter be discussed further at the next Annual Meeting.

During the year the Division carried out enquiries on behalf of the Society in relation to many aspects of air pollution and the assistance which was received from Chief Public Health Inspectors in the North East Authorities is greatly appreciated. In particular the local press were very helpful during our brief action dealing with laggard authorities and it is certain that they will play an important part in the controversy of the future which will eventually arise when the slow progress of the North East is put under the official microscope.

Despite the mood of uncertainty created by fuel difficulties, labour shortages for conversion work and the hazards of Local Government Reorganisation the Division continues to be very much alive and will surely play an important part in raising the North East from its present lowly position in the National Clean Air League Table.

L. MAIR
Hon. Secretary

West Midlands Division

The West Midlands Division, as to an extent were certain other Divisions, was severely restricted in its activities during the period under review because of the pressure of work created on the one hand by local government reform, and on the other by the sudden increased interest in local authority pollution control work.

The main activity during the year was an extensive road vehicle exhaust emission monitoring exercise. This was carried out on vehicles visiting the Automobile Association headquarters in Birmingham during the Birmingham Festival of Motoring in June 1972. A large number of vehicles were examined for hydrocarbons and carbon monoxide, and it was found that approximately 60% of the vehicles tested would not have passed the proposed EEC limit of 4.5% carbon monoxide.

F. REYNOLDS
Hon. Secretary

East Midlands Division

Divisional Meetings

There have been three meetings of the Division during the year.

The Annual General Meeting was held at Chesterfield and was something of an occasion, since we had with us both the Chairman and the Director of the Society, and the meeting also marked the retirement of Mr. G. Drabble, Chief Public Health Inspector of Chesterfield, as Secretary of the Division. Cllr. C. E. Holland of Sutton-in-Ashfield U.D.C. was elected as Chairman for the year.

In October, 1971 we met in Peterborough on a perfect autumn day when we were given a full description of the very extensive development taking place there and in the afternoon were taken on a tour of the development areas. We saw amongst other things a large district heating scheme to be powered by boilers fired by natural gas.

During the meeting a presentation was made to Mr. G. Drabble as a mark of appreciation of his work as Secretary of the Division.

In March the members went to Radiation Parkray Ltd. at Belper to see the production of the 'Coalmaster'. This is a room heater designed to burn bituminous coal, in the form of washed singles, and to do this smokelessly. We were also able to see a prototype under fire. This meeting should have taken place in 1971 but the Secretary was prevented from sending out the notices by the postal strike. The meeting almost foundered again because of the miners' strike, since the rationing of electricity could have meant that the works would be shut down. Fortunately the strike ended just in time for the visit to proceed.

Divisional Council

The Divisional Council has also met on three occasions. A resolution was sent to Headquarters asking that the Society should recommend the provision of part of the exchequer monies to local authorities should be made subject to it being used specifically for smoke control work but the Executive Council did not feel able to support this.

A simple questionnaire was sent to all the local authorities in the Division asking for details of the current situation regarding smoke control. Only 28 of the authorities who replied were currently carrying out domestic smoke control procedure.

Elections to Executive Council

There were five nominations from this Division and the three people elected were Councillor Mrs. D. Ashley, Mr. R. Pane and Mr. T. Henry Turner. The return of nominations through Secretaries of Divisions caused some difficulty because of the timing.

New Member

During the year the Urban District Council of Matlock was transferred to the East Midlands Division.

Pamphlet on Air, Soil and Water Pollution

Numerous enquiries, mainly from secondary school children, for information to help with projects on the environment prompted me to suggest to Headquarters that a basic pamphlet on air, soil and water pollution should be produced by the Society as an introduction to the problem and as a guide to further information. There were objections that the Society is not qualified to speak on soil and water and I therefore suggested a pamphlet in conjunction with two comparable organisations who would cover the soil and water pollution aspects. I am pleased to say that this suggestion has been accepted.

Personalia

In an organisation where so many people give unstinting service it is with hesitation that one mentions individuals. I feel, however, that I should place on record the service of Mr. G. Hiller, Chief Public Health Inspector of Leicester, who has retired during this year.

E. F. RAVEN
Hon. Secretary

Northern Ireland Division

Despite the unsettled conditions in the Province, 1972 has been a most active year for the Northern Ireland Division.

The Annual General Meeting was held in B.M.A. House, Belfast, on Wednesday, 26th January, 1972, and the Chairman, R. Campbell Brown, presided over a large attendance of members. After delivering his review of progress for the year 1971, the election of officers took place and this resulted in the re-election of the Chairman, Deputy Chairman and Honorary Secretary/Treasurer. Members elected to serve on the Divisional Council were as follows: Chairman, Deputy Chairman, Honorary Secretary/Treasurer, Alderman W. Shannon, J.P., W. J. Davison, J. Stanley Gardiner, Col. H. J. Porter, A. Reynolds, Dr. J. McA. Taggart, W. E. C. O'Brien, K. Lynas and A. O'Neil.

After the business was concluded a short illustrated talk on the 'Maxiglow' smokeless fuel plant operated by Cawoods Patent Fuels Ltd., Belfast, was given by Mr. D. Hinchliff, Alkali and Radiochemical Inspector for Northern Ireland.

The main event of the year was the Division's Spring Meeting which was held in the Slieve Donard Hotel, Newcastle, Co. Down, on Tuesday, 16th May, 1972. With an attendance of almost 100 delegates the meeting was formally opened by Mr. Roy Bradford, M.P., the former Minister of Development in the Northern Ireland Government. The first paper, "How climatic information can guide work in air pollution control", was delivered by Mr. Mark Patterson (Imperial College of Science and Technology, London). Mr. Patterson's interesting and practical paper gave delegates a fresh approach to the problem of air pollution and was extremely well received. Mr. Frank Reynolds (Chief Air Pollution and Noise Abatement Inspector, Birmingham) followed Mr. Patterson to the rostrum to deliver his paper, "The control of air pollution including noise in the City of Birmingham". Here the practical problems were fully illustrated and explained and delegates had the opportunity to listen to someone so intimately involved with the air pollution problems of a large urban area. Unfortunately time seemed to run out too quickly and delegates reluctantly released Mr. Reynolds to a well-deserved lunch. After an excellent meal the final paper of the day was delivered by Professor John Pemberton (Queen's University, Belfast). This was entitled "The medical aspects of air pollution". The need for our Society and its continuing efforts to achieve clean air was never more clearly apparent than during the course of this lecture. Finally, all three speakers together with the Division's Chairman, R. Campbell Brown, formed a panel to answer any questions raised by the papers. This proved to be a lively session and indicated quite clearly the amount of interest and thought stimulated by the speakers. Time once again proved to be the enemy and an excellent meeting ended with delegates enjoying the lavish hospitality of the Coal Advisory Service at a reception in the hotel.

The year 1972 has also seen the retirement of Bill O'Brien from his position of Divisional Public Health Inspector with Down County Health Authority. His work as former Honorary Secretary of the Northern Ireland Division is a monument to the clean air cause, and this also rings true of his achievements in County Down. Bill was instrumental in establishing the Province's first smoke control area in Castlereagh R.D.C. and all our members wish both Bill and his wife many years of happy retirement.

Smoke Control has continued to progress satisfactorily during the year with 36 smoke control orders currently in operation (August). Thirteen more have been confirmed but are not in operation and 3 smoke control orders have been submitted to the Ministry of Development but are not yet confirmed.

B. P. HANNA
Hon. Secretary

South West Division

The Division's established policy of holding three full meetings each year has been followed, and since the last Annual Report of the Division a new Honorary Secretary has been appointed. The former Secretary, Mr. G. J. Creech, who was the Chief Public Health Inspector of Bristol until his retirement in June 1971, had served as Secretary for six years. It was under his very capable guidance that the old Bristol and West Clean Air Society was disbanded thus providing the nucleus of the South West Division of the National Society for Clean Air. Mr. Creech served the Division well but in the latter years was prevented from playing as full a part as he would have liked because of ill health. In fact, he was prevented from attending his last Annual General Meeting because of appendicitis. Mr. Creech is now well and he has both the Division's and the National Society's best wishes for a long and happy retirement.

Last year's Annual General Meeting, which had to be postponed due to the postal strike, was eventually held in June 1971. This meeting was held in Bristol when the Division's hosts were the South West Gas Board and the principal item on the Agenda was the conversion to natural gas in the South West. Mr. A. Olpin, the Board's Publicity and Public Relations Officer (Conversion), presented a paper on natural gas and the conversion programme, outlining the programme for the South West which should be completed by 1975. At the conclusion of his talk the Gas Council's film "The Air My Enemy" was shown to members and a full discussion ensued.

The meeting in October was held at the Westbury Works of the Associated Portland Cement Manufacturers Ltd. (Blue Circle Group), where the main business of the afternoon's meeting was a tour of the Works and a talk on the manufacture of cement, with particular emphasis on the measures taken to control air pollution.

The 1972 Annual General Meeting was held in March in Bristol and the Division departed from the traditional form of Annual General Meeting. Both business meetings, that of the Divisional Council and the Division, were held in the morning at the Council House, Bristol, and these meetings were privileged by a visit from both the Director and the Chairman, Mr. S. Cayton. These visitors, together with representatives of the Divisional Council, were afterwards entertained to lunch by the Lord Mayor of Bristol. The afternoon was devoted to a Symposium on Pollution from Motor Vehicles with speakers representing the motor industry, the fuel industry and the National Society. The speakers were Mr. C. D. Haynes of the British Leyland Motor Corporation's Atmospheric Pollution Control Research Laboratory, Mr. G. L. Goodacre, a Consultant, and our own Vice-Chairman, a member of the Technical Committee, Mr. Philip Draper. This was linked to the testing of motor vehicle exhausts in Bristol on the previous day, and although the total number of vehicles tested was not as great as might have been hoped, both this and the symposium attracted much publicity for the National Society. Admiral Sharp was interviewed on both ITV and BBC TV channels, and also on national and local radio, these being in addition to the publicity received in the local press. From this point of view this exercise was most successful, and it might well set a pattern for perhaps one meeting per year in the future.

In June 1972 the Division visited the National Coal Board's Research Establishment at Stoke Orchard, near Cheltenham in Gloucestershire. A most successful meeting was held, the members of the Division being shown some of the work which is being carried on at this establishment.

Among matters receiving the attention of the Divisional Council during the year were alterations to the Division's boundaries in co-operation with the South East Division, and ways of co-operating with local branches of the Conservation Society. In fact, the Secretary addressed a meeting of the Bristol Branch of the Conservation Society on the control of air pollution during the year.

Unfortunately there has been no satisfactory outcome to the Division's attempts to interest the Parliamentary and Local Government Committee in seeking the amendment of Section 6 of the Clean Air Act 1968, and in spite of the concern expressed, not only by this Division but by a majority of the other Divisions, the anomaly in the enforcement of chimney height control still exists. Although the Department of the Environment obviously thinks otherwise, going on bended knee to trade associations is not a satisfactory method of obtaining adequate chimney heights.

D. J. BARNETT
Hon. Secretary

Scottish Division

The Division met on two occasions during the year and the Executive Committee met on three occasions, the Annual General Meeting being held in Perth prior to the Conference.

The Conference was held in Perth from 19th to 21st May and the following papers were given, viz: — "Future Prospects of Solid Smokeless Fuels for Local Authority Clean Air Programmes"—this was a forum of the various solid fuel interests; "Future Prospects of Hydro-Electricity" —this paper was followed by a visit to the works of the North of Scotland Hydro-Electricity Board at Pitlochry; "Designs with Air Pollution in Mind"; and "Air Pollution from the Medical Aspect". All of these papers were most informative and proved of great interest to the delegates. Perth Town Council provided a civic lunch for the delegates on 20th May and the Division's annual lunch was held on 21st May.

During the course of the year the Division started discussions with the University of Strathclyde with a view to sponsoring a post-graduate research project into air pollution in West Central Scotland. It is anticipated that the fuel interests and the local authorities in the area will contribute towards the cost of the project.

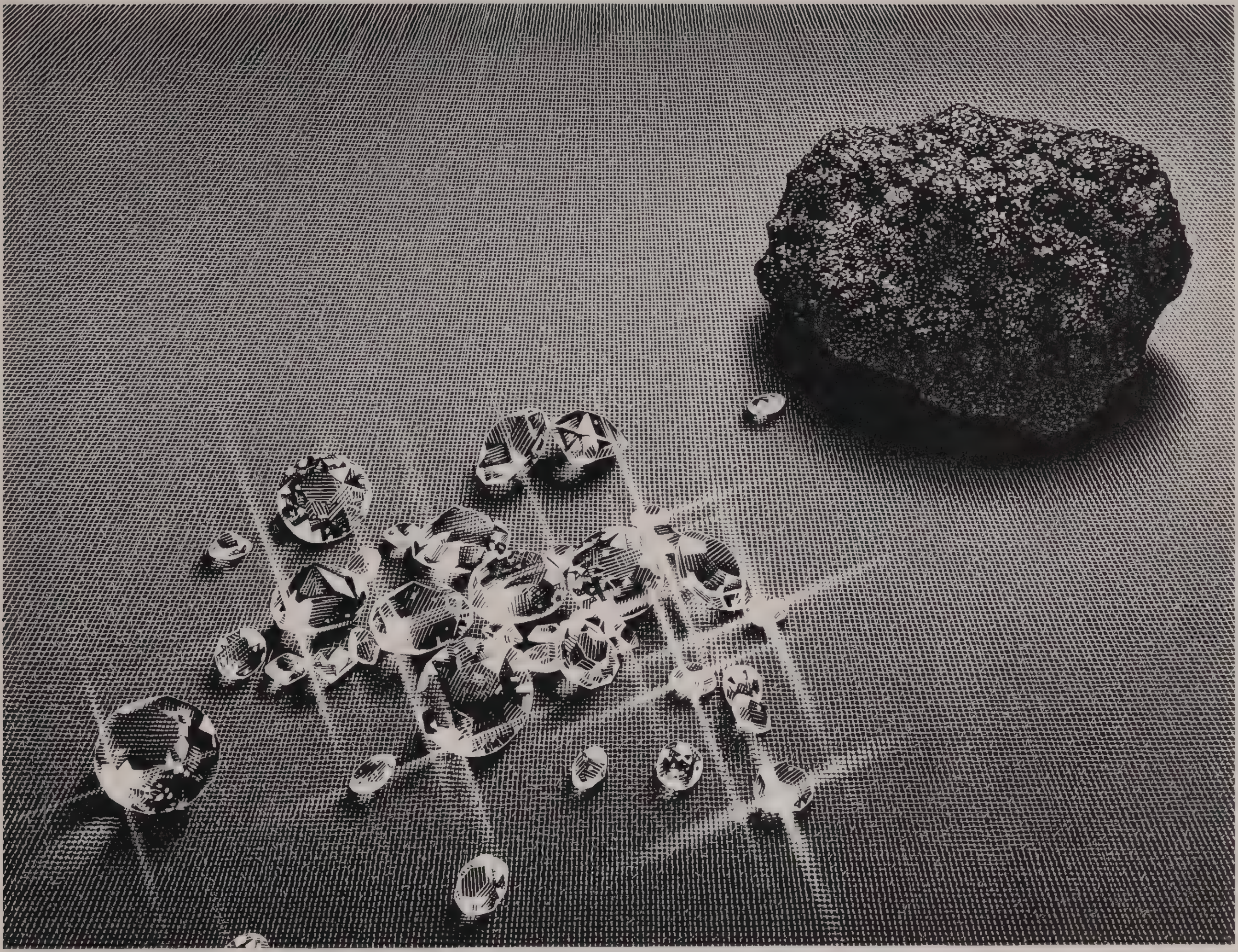
The 56th Annual Winter Session of the classes for firemen, boiler attendants, engineers, etc., organised by the Division, in conjunction with the Health Department of the Corporation of Glasgow, commenced in October and attendances continue to be encouraging. There is now an added inducement for participants in that the National Joint Councils for Local Authority Services (Scottish Councils) have recognised the certificate awarded as a qualification which merits additional payment.

The Division is perturbed about the sale of unauthorised fuel in smoke control areas and an approach has been made to the Clean Air Council for Scotland with a view to representations being made to the Government for harsher penalties for offences, as it is felt that the existing penalties are no longer a deterrent.

F. J. FEELEY, A.C.I.S.
Hon. Secretary and Treasurer

Notes

Notes



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THE

CLEAN AIR YEAR BOOK

FOR

1974

National Society for Clean Air

Smoke was once a token of industrial prosperity.

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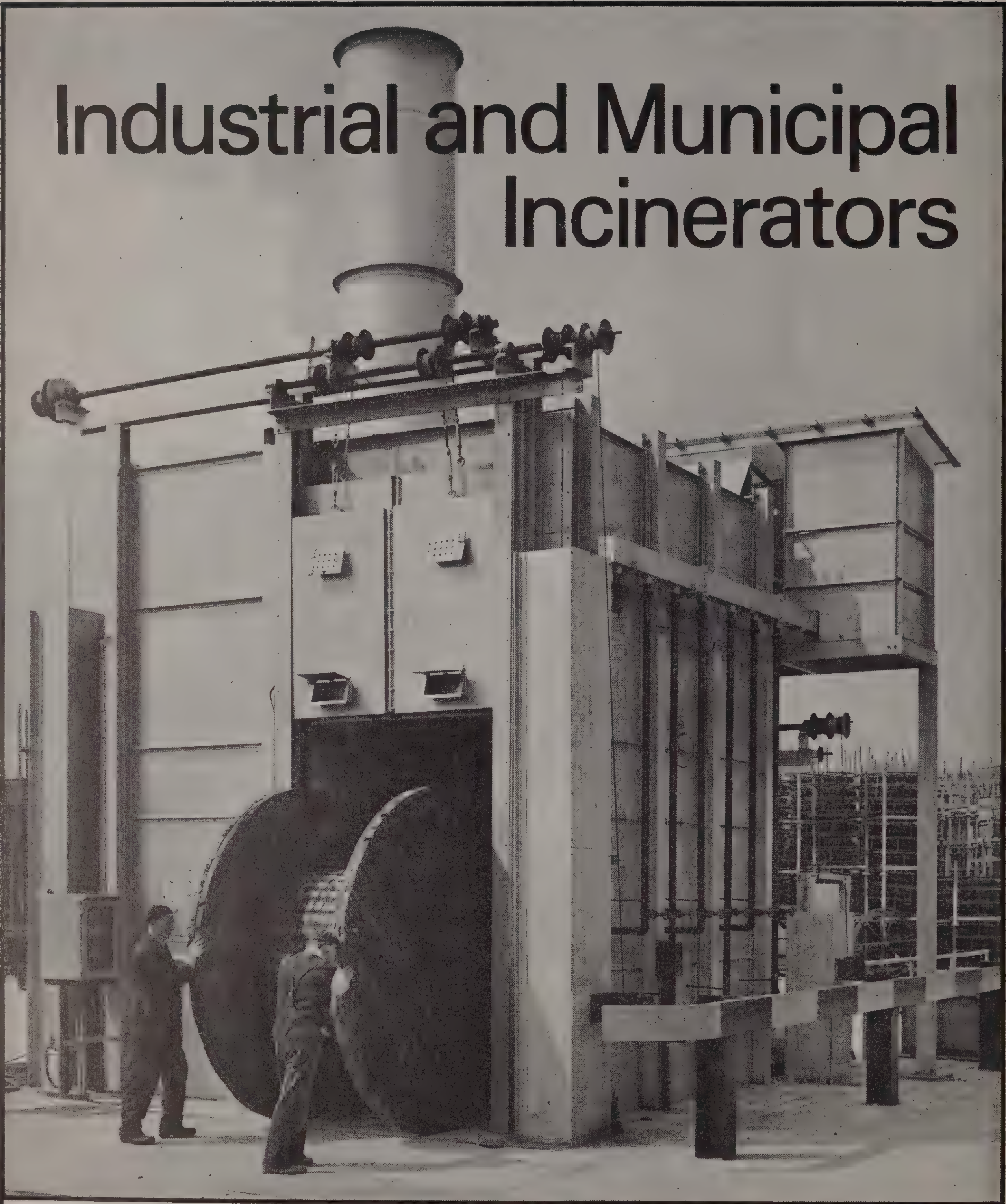

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CLEAN AIR YEAR BOOK
1974

Contents

Section 1

Clean Air Progress 5

Section 2

British Standards Relating to Air Pollution 7
The History of Air Pollution in Great Britain 8
The Cost of Air Pollution 10
Estimates of Air Pollution in the United Kingdom in the year 1971/72 12
Smoke Control Areas 14
Major Smog Disasters 21
An Outline of the Law Relating to Air Pollution 22
The Ringelmann Chart 42

Section 3

Air Pollution Research Programmes in the United Kingdom 45
The Warren Spring Laboratory of the Department of Trade and Industry 62
The Central Electricity Generating Board 63
The Atomic Energy Research Establishment 64
The Medical Research Council's Air Pollution Research Unit 66
The National Industrial Fuel Efficiency Service Ltd 68

Section 4

Recent Books, Paper and Reports 69
Films and Filmstrips 70
Guide to Publications 73
Services Provided by the NSCA 79
The Clean Air Case 80

Section 5

Directory of Consultants 81
The International Union of Air Pollution Prevention Associations 83
Directory of Organizations 84
Trade Directory and Buyers Guide 88

Section 6

NSCA Officers, Council and Staff 102
Information about the Society 103
NSCA List of Members 104
NSCA Annual Report and Accounts 110
Divisional Reports 116

Index to Advertisers

Shell-Mex & B.P. Ltd	Cover ii
Coalite & Chemical Products Ltd	1
The Incinerator Company	2
Western Precipitation Division of Joy Manufacturing	4
Medion Ltd	11
Saniguard Appliances Ltd	13
Lodge-Cottrell & Buell Ltd	44
Diana Wylie Ltd	109
C. F. Casella & Co Ltd	120
Solid Smokeless Fuels Federation	Cover iii
Nailsea Engineering Company Ltd	Cover iv

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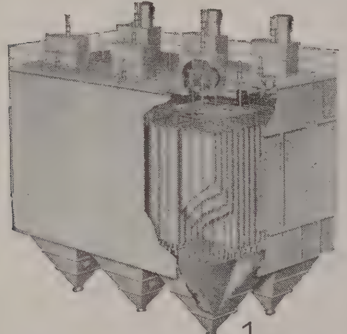
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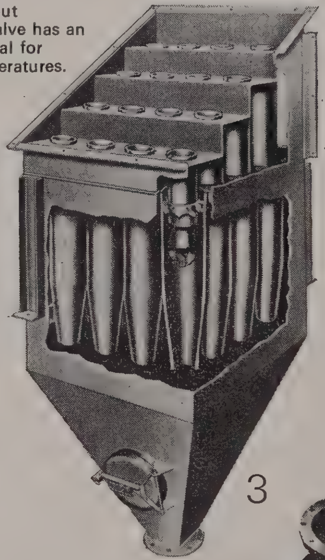
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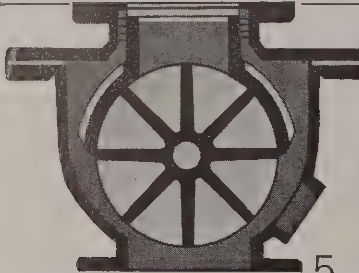
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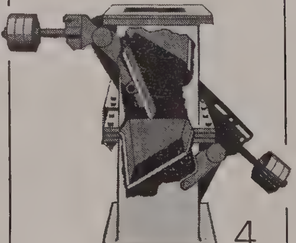
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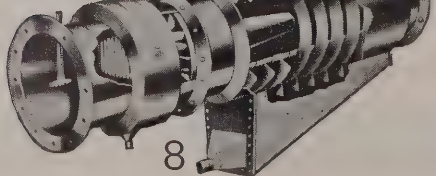
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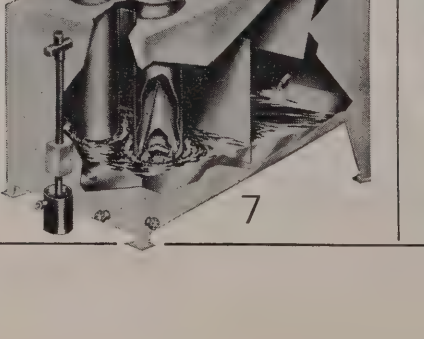
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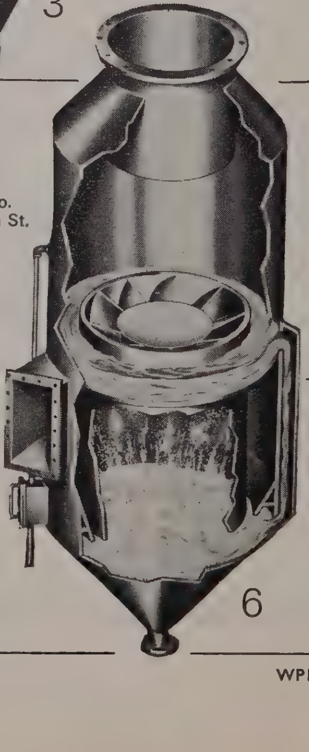
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WP10

Section 1

Clean Air Progress

A Review for 1972/73

The Clean Air Year Book is now published annually on the 1st January and so the period of twelve months under review, to allow time for printing and publication, is from the end of October, 1972 until early November, 1973.

In the international field, the Third International Clean Air Congress was held at the Congress Centre, The New Exhibition Grounds, Dusseldorf, from the 8th—12th October, 1973. The Congress was attended by some 1,500 delegates from 42 nations; over a period of four days, 180 papers were presented and discussed at four simultaneous sessions almost all of which were well attended. Although there were fewer delegates and fewer papers than at the previous International Conference in Washington, the size of the Conference still serves to show the world-wide interest in clean air. The papers presented were of a high scientific value although it could be said of some that the information they contained had already been published elsewhere. But perhaps one of the more pleasing features was the number of papers presented by younger people of all nationalities. Great Britain contributed six papers and there was one British paper in every section. The Conference programme naturally included the usual outings and similar activities, and perhaps one of the most interesting of these was the special trip arranged by river steamer through the heart of the industrial Rhineland. Here it was possible to see not only industry working at its full potential but also to see pollution, to smell it, to taste it and to hear it. It served as a salutory reminder that the main task for us all is not just to attend Congresses and to discuss the abatement of pollution in all its aspects, technical, administrative and sociological, but really to get on with the main task of actually cleaning up such pollution. Our chief concern must still be that effort must continue, internationally as well as nationally, to this end.

On the domestic front, the progress foreshadowed in our last review has been maintained. 1972 was, indeed, the vintage year for smoke control orders. 360 orders—that is a figure 7 per cent higher than the total for 1967—were confirmed; and 1973 got off to a very good start. There were 173 orders in the first six months. This is actually three less than in the same period in 1972 but the orders confirmed in 1973 covered 19 per cent more premises. All in all, smoke control does seem to have made a very salutary and rapid recovery from the doldrums of 1970.

It must not be expected however, that it will be possible to maintain this rate of progress. Some forty authorities have now completed their smoke control programmes, and as each month passes so more authorities will complete. It is therefore inevitable that the number of smoke control orders submitted and confirmed will begin to fall off, especially as most authorities which have completed, or are on the point of completing, are in the so-called "black" areas. The record for the "white" areas is not so good. But progress is being made. It is hoped that the possible use of pilot schemes, which some "white" areas are anxious to introduce, might provide a stimulus for certain authorities to institute smoke control and to follow up such pilot schemes with proper programmes.

What has now become clear is that really there is no longer any need to distinguish between the "black" and "white" areas. This is already being discussed by the Clean Air Council and by the Department of the Environment and it is to be hoped that by the time that this review is printed and published, there will be no such things as "black" and "white" areas. In any event, the reorganisation of local authorities will not only have a profound effect but also will produce a number of anomalies. Some authorities, previously "black", will find themselves part of a new "white" authority and vice-versa. Some authorities who have nearly completed their smoke control programmes will find that they are absorbing authorities where no start has yet been made. Others, who have barely made a start or have only paid lip service to smoke control, will find they are absorbing authorities who have completed their programmes. This all argues for the abolition of the designations "black" and "white". It is also to be hoped that those "old" authorities who have got on with the important business of smoke control, will be able to spread their enthusiasm to their former neighbours who have not done so, but who will soon be part of the same authority.

On the industrial front, the main step forward has been the proposed action on report of the Working Party on Information about Industrial Emissions to the Atmosphere. The second report of the Royal Commission on Environmental Pollution, published in March, 1972, made recommendations on the publication of information about industrial wastes. In July, 1972 the Clean Air Council set up a Working Party to examine the points raised by the Royal Commission and to make recommendations. The Working Party issued its report on July 9th, 1973 and recommended that the new district authorities should empowered to set up special local committees on industrial emissions to the atmosphere and that such committees should be representative of the local authority, local industry and the local public. The committees would have a duty to collect and consider information about air quality and emissions to the atmosphere; to publish reports; and to work as a local source of knowledge. The Secretary of State for the Environment however, considered that he could not accept this recommendation in the form in which it was made because it would have been out of accord with general local government practice and in particular with the Minister's policy of conferring, where ever possible, in matters of local government, autonomous powers upon local authorities. While the Minister appreciated the view of many industrialists that the responsibility in this field should be shared between the local authority and local industrial interests, he concluded that the proper course must be to confer upon the elected local authorities themselves the responsibility for carrying out the work, but that they should be subject to a statutory responsibility to consult representatives of industry.

Appropriate powers will therefore be included in the Protection of the Environment Bill which it is hoped will become law by mid-1974. This undoubtedly will contribute a big step forward. It will give the new district authorities not only the power to provide the information which is now being sought by so many, but also the responsibility of collecting and disseminating such information.

Turning to road vehicles, the legislation forecast in our last review has now reached the statute book. What is more to the point, the new cars now coming on to our roads have to comply with the limits of emissions laid down by E.C.E. Regulation number 15; we are now getting cleaner cars on our roads.

All in all we think it can be said that 1973 has been a good year for clean air.

Section 2

British Standards Relating to Air Pollution

B.S.

758 Small domestic hot-water supply boilers using solid fuel.
Part 1: 1955 Manually controlled boilers. Amendments PD 2418, 1956; PD 2698, 1957; PD 4317, 1961; PD 4432, 1962.
Part 2: 1960 Thermostat-controlled boilers. Amendment PD 4139, 1961.

893 Methods of testing dust extraction plant and the emission of solids from chimneys of electric power stations. 1940. Amendment PD 26, 1942.

1251 Open fireplace components. 1970.
Four sections dealing with:—
1. Firebacks for 350mm, 400mm and 450mm open fires.
2. Fireplace surrounds and hearths.
3. Adjustable chimney-throat restrictors.
4. Lintels for open fire assemblies.

1252 Domestic solid fuel cookers with integral boilers. 1957. Amendments PD 3383, 1959; PD 4212, 1961; PD 4822, 1963.

1334 The use of thermal insulating materials for central heating and hot and cold water supply installations. 1969. (Metric).

1747 Methods for the measurement of air pollution. (Metric).
Part 1: 1961. Deposit Gauges.
Part 2: 1969. Determination of concentration of suspended matter.
Part 3: 1969. Determination of sulphur dioxide.
Part 4: 1969 The lead dioxide method.
Part 5: 1972. Directional dust gauges.

1756 Methods for the sampling and analysis of flue gases. 1971.
Part 1: 1971. Methods of sampling.
Part 2: 1971. Analysis by the Orsat apparatus.
Part 3: 1971. Analysis by the Haldane apparatus.
Part 4: 1965. Miscellaneous analyses. Amendment PD 5858, 1966.
Part 5: 1971. Semi-routine analyses.

1816 Heavy duty cooking ranges (solid fuel) 1957. Amendment PD 2814, 1957.

1846 Glossary of terms relating to solid fuel burning equipment.
Part 1: 1968. Domestic appliances.
Part 2: 1968. Industrial water heating and steam-raising installations.

2740 Simple smoke alarms and alarm metering devices, 1969. (Metric).

2741 Recommendations for the construction of simple smoke viewers. 1969. (Metric).

B.S.

2742 Notes on the use of the Ringelmann and miniature smoke charts. 1969. (Metric). Addendum No. 1. (1972). The calibration of instruments in Ringelmann numbers.

2742C Ringelmann Chart. 1957.

2742M Miniature smoke chart. 1960.

2811 Smoke density indicators and recorders. 1969. (Metric).

2845 Coke-burning inset open fires without boiler and without convection.
Part 1: 1957. Dimensional and constructional requirements. Amendments PD 3517, 1959; PD 3981, 1960.
Part 2: 1959. Performance and constructional requirements. Amendments PD 3668, 1960; PD 3982, 1960; PD 4848, 1963.

3048 Code for the continuous sampling and automatic analysis of flue gases. Indicators and recorders. 1968. (Complementary to B.S. 1756, which covers manually operated instruments.)

3107 Small incinerators for the destruction of hospital dressings. 1959.

3128 Constructional and performance requirements for inset open fires with boiler and without convection. 1959. Amendments PD 3667, 1960; PD 3980, 1960; PD 4100, 1961; PD 4849, 1963; PD 5517, 1965.

3142 Manufactured solid smokeless fuels for household use.
Part 1: 1965. Cokes for domestic open fires.
Part 2: 1965. Cokes for domestic closed appliances.
Part 3: 1970. Specially reactive fuels for all types of domestic open fire.

3250 The thermal testing of domestic solid fuel burning appliances with convection.
Part 1: 1960. Flue loss method. Amendment PD 5140, 1964.
Part 2: 1961. Hood method. Amendment PD 4205, 1961.

3316 Large incinerators for the destruction of hospital waste. 1960.

3328 Domestic gas pokers and portable underbar ignition burners. 1961.

3376 Open fires with convection, with or without boiler. 1961.

3377 Back boilers for use with domestic solid fuel appliances. 1969. (Metric).

3378 Domestic heating stores using coke and other solid fuels. 1961.

B.S.

3405 Simplified methods for measurement of grit and dust emission. 1971.

3813 Incinerators for waste from trade and residential premises.
Part 1: 1964. Capacities between 50 lb./h. and 1000 lb./h.

3841 Method for the measurement of smoke from manufactured solid fuels for domestic open fires. 1972.

3929 Domestic solid fuel ignition pokers and portable undergrate ignition burners for use with commercial butane. 1965.

4076 Steel chimneys. 1966.

4433 Independent thermostatically controlled central heating boilers, with rated outputs up to 44kW. (Metric).
Part 1: 1969. Boilers with undergrate ash removal designed to burn solid smokeless fuels.
Part 2: 1969. Gravity feed boilers designed to burn small anthracite.

4454 Methods for determination of sulphur in petroleum products (bomb method) NZ 12 page Gr. 3 identical with joint method IP61/65 ASTM d 129-64 and with explanatory notes.

4555 High efficient dust respirator M+I 12 page Gr. 3.
Specifies requirements for dust respirators for use in areas where highly toxic particulate materials, including radioactive substances are handled. (SBN 5800526 3).

B.S.

4718 1971 methods of tests for silencer for air distribution systems. Measurement of performance of unit silencers and silencing elements for ducted ventilating and air conditioning systems (aspects considered are insertion loss + generated noise level).

CP3 Chapter III Part 1 1960 building Part 1 imperial units. Sound insulation and noise reduction.
114 pages Gr. 8 Amendment AMD 956 April 1972 (Gr. 1).
This code gives guidance on the planning, siting and construction of various classes of buildings for ensuring adequate sound insulation and noise reduction.
A section is included on the legal aspects of noise nuisance. (SBN 580051420).

PD 6434 Recommendations for the design and testing of smoke reducing solid fuel burning domestic appliances. 1969.

AU 141a The performance of diesel engines for road vehicles. 1971.

All the above Standards are obtainable direct from the British Standards Institution at British Standards House, 2 Park Street, London, W.1. (individual copies) or Newton House, 101-113, Pentonville Road, London, N.1. (bulk orders). British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The History of Air Pollution in Great Britain

852 First records of the use of coal in England.

1228 Record of "Sacoles Lane" (sea-coals) in London.

1257 Eleanor, Queen of Henry III, left Nottingham for Tutbury on account of the smoke nuisance.

1273 Use of coal prohibited in London as being "prejudicial to health".

1306 Royal Proclamation prohibiting artificers from using sea-coal in their furnaces. Record of the execution of one offender.

1307 Commission of Inquiry appointed to "inquire of all such who burnt sea-coal in the city or parts adjoining, and to punish them for the first offence with great fines and ransoms, and upon the second offence to demolish their furnaces".

1563 Scarcity of wood fuel led to an Act prohibiting the export of wood. Consequent expansion of the coal trade.

1578 Queen Elizabeth I "findeth hersealfe greately greved and annoyed with the taste and smoke of the seacooles". Westminster brewers offered to burn wood because of her objection to coal smoke. Elizabeth, James I and Charles I all imposed export duties on coal.

1595 Thomas Owen brought Welsh coal and anthracite to London to demonstrate its smokelessness.

XVI century (Elizabeth's reign). Prohibition of coal in London whilst Parliament was sitting.

1603 Sir Hugh Platt's smokeless briquettes.

1648 Petition of Londoners to Parliament to prohibit the importation of coal from Newcastle on account of the injury they experienced.

1661 John Evelyn submitted his "Fumifugium, or the Smoake of London Dissipated", to Charles II.

1700 Publication of "Campania Foelix", with a "Discourse on the Fuel of London", by Timothy Nourse,—mentioned the "stink" of coal.

Circ. **1799** Benjamin Thompson's smokeless grates.

1801 Manchester Corporation Nuisance Committee on "Smoake".

1819 Committee appointed by Parliament to inquire how far persons using steam engines and furnaces could erect them in a manner less prejudicial to public health and comfort.

1843 A Select Committee recommended the introduction of a Bill dealing with nuisances from furnaces and steam engines.

1845 Another Select Committee reported that it was not desirable to extend the provisions of an Act beyond furnaces used for steam generation.

1845	Manchester cotton mill was observed to emit black smoke for 8 hrs. 52 mins. out of 9 hrs.
1845	Railway Clauses Consolidated Act requiring engines to consume their own smoke.
1847	The Town Improvement Clauses Act contained a section dealing with factory smoke.
1850	Manchester Smoke Inspector's Report—over 500 factory premises inspected—300 notices or cautions issued.
1853-6	Smoke Abatement Acts relating to the Metropolitan area.
1863	Alkali, etc. Works Regulation Act.
1866	The Sanitary Act empowered sanitary authorities to take action in cases of smoke nuisances.
1875	The Public Health Act containing a smoke abatement section on which legislation to the present day has been based.
1881	Formation of a Smoke Abatement Committee as a result of a movement started by the Kyrle Society and the Public Health Society.
1881	Smoke Abatement Exhibition at South Kensington organized by the Public Health and Kyrle Societies.
1882	Formation of the National Smoke Abatement Institution.
1882	Manchester Noxious Vapours Association held an exhibition.
1887	Failure of the Smoke Abatement (Metropolis) Bill in the House of Lords.
1891	The Public Health (London) Act.
1899	Formation of the Coal Smoke Abatement Society, led by Sir William Richmond, R.A., and Dr. H. A. Des Vœux (concerned mainly with London).
1903	Birmingham had four smoke inspectors.
1904	London County Council published a comprehensive report on the London smoke problem.
1905	The Government published a report on laws regarding smoke in other countries.
1905	Leeds appointed a full time smoke inspector. About this time the London Coal Smoke Abatement Society appointed smoke inspectors, but found little official support.
1906	The Alkali, etc. Works Regulation Act, which extended and consolidated previous similar Acts.
1909	Sheffield Smoke Abatement Exhibition, at which was set up the Smoke Abatement League of Great Britain (mainly for the provinces and centred later in Manchester and Glasgow).
1912	International Smoke Abatement Exhibition in London, organized by the Coal Smoke Abatement Society, leading to the formation of a Committee for the Investigation of Atmospheric Pollution.
1913	Smoke Abatement Bill introduced in the House of Commons by A. G. C. Harvey, M.P.
1914	Smoke Abatement Bill introduced in the House of Lords by Lord Newton. Withdrawn on the appointment of a Departmental Committee to investigate the problem.
1920	Committee re-formed after the war with Lord Newton as Chairman — they issued an Interim Report—dealing largely with domestic smoke.
1921	Publication of the Final Report of the Newton Committee.
1926	Public Health (Smoke Abatement) Act by which the 1875 and 1891 Acts were amended and extended.
1927	Establishment of first regional committees of local authorities.
1929	Amalgamation of the Coal Smoke Abatement Society and Smoke Abatement League of Great Britain to form the National Smoke Abatement Society. First publication of a journal (*Clean Air*) devoted to air pollution.
1935	First records of completely smokeless housing estates.
1936	Public Health Act, in which were included the provisions of the Smoke Abatement Act of 1926.
1946	Simon Report on Domestic Fuel Policy, recommending, *inter alia*, measures for domestic smoke prevention.
1946	First smokeless zone and prior approval legislation (Manchester Corporation Act).
1951	First smokeless zone established (in Coventry).
1952	Ridley Report on "Policy for the Use of Fuel and Power Resources", recommending, *inter alia*, measures for smoke prevention.
1952	London smog disaster, the most serious for many years, with a death roll of 4,000 (*q.v.*).
1953	Beaver Committee on Air Pollution was set up by the Government and published an Interim Report.
1954	Final Report of the Beaver Committee.
1954	A Clean Air Bill introduced by Gerald Nabarro, M.P., and withdrawn (4 February 1955) on Government undertaking to introduce their own Bill.
1955	Whole of City of London declared a smokeless zone.
1956	Clean Air Act.
1958	National Smoke Abatement Society became incorporated under new name of National Society for Clean Air.
1959	International Diamond Jubilee Clean Air Conference and Exhibition (N.S.C.A.), London.
1962	Smog episode in London and other cities. Estimated death roll of 750 in Greater London.
1962	Holborn M.B. first local authority in country to reach its final target under Clean Air Act.
1964	Amendments to Clean Air Act in Housing Act, 1964, modifying smoke control area policy. Clean Air Act (Northern Ireland).
1966	First Congress of the new International Union of Air Pollution Prevention Associations (in London).
1966	Alkali, etc. Works Order revoked all earlier seven Orders and consolidated them, making a few minor alterations to the lists of scheduled works and noxious or offensive gases.
1968	Clean Air Act passed.
1969	Clean Air Act brought into operation.
1970	Second Congress of the International Union of Air Pollution Prevention Associations (in Washington).
1971	The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations and the Clean Air (Emission of Grit and Dust from Furnaces) Regulations.
1971	The Alkali & C. Works Order.
1971	The Royal Commission on Environmental Pollution.
1972	U.N. Conference on the Human Environment, Stockholm.
1973	Motor Vehicles (Construction and Use) Regulations 1973

The Cost of Air Pollution

A general enquiry into the cost of air pollution in Britain made by a sub-committee of the Beaver Committee, the findings of which were included as an appendix in the final report of the Committee in 1954 estimated the total cost as some £250m a year.

In November 1972, the Programmes and Analysis Unit of the Department of Trade and Industry and the United Kingdom Atomic Energy Authority published their report "An Economic and Technical Appraisal of Air Pollution in the United Kingdom". This report quotes the direct annual cost of air pollution as some £410m. a year, the major items of which are:

	£m per annum
Laundry etc,	½
Window cleaning	5
Corrosion and protection of metals	42
Textiles, paper, etc.	33
Agricultural produce	195
Health	130

In addition, the report estimates that there is a "social" or disamenity cost to the country of about £780m. a year, which includes £510m. for health and £100m. for amenity.

The total cost of air pollution in the United Kingdom may therefore be said to be of the order of £1190m. a year, which represents about two per cent of the gross national product.

Expenditure on Air Pollution Control

The amount of money spent by scheduled works in capital working costs between 1958 and 1968 has been estimated from the returns submitted and is summarised in the table below. Working costs include depreciation and interest, operations, maintenance and repairs, overheads and miscellaneous.

(*From the 105th Annual Report of the Chief Alkali Inspector, 1968*)

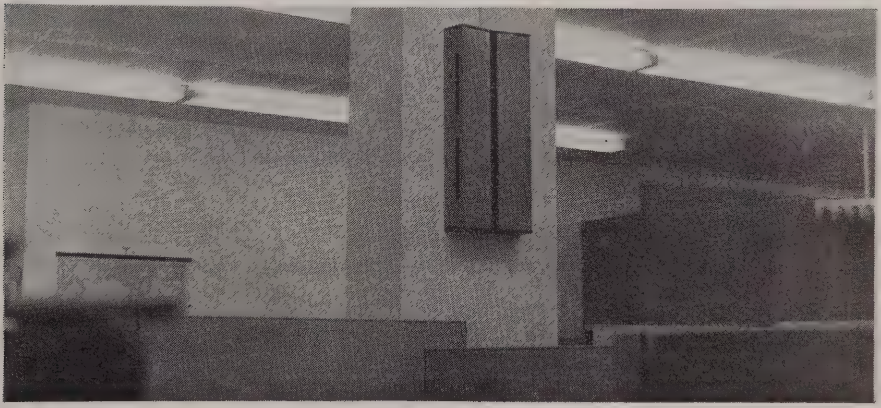
Works	*Capital*	*Research and Development*	*10-year Working Costs*	*Latest year's Working Costs*
1. Electricity	75,731,000	856,000	126,691,000	15,300,000
2. Cement	6,216,000	301,000	6,442,000	1,000,000
3. Petroleum	6,822,000	536,000	11,667,000	1,788,000
4. Gas	2,839,000	—	4,474,000	350,000
5. Coke Ovens	2,909,000	242,000	6,126,000	710,000
6. Lime	976,000	4,000	707,000	118,000
7. Ceramics	2,090,000	163,000	3,011,000	382,000
8. Iron and Steel	26,430,000	1,235,000	93,351,000	10,364,000
9. Non-ferrous Metals	5,762,000	656,000	16,449,000	2,262,000
10. Chemical	20,527,000	952,000	55,516,000	6,782,000
TOTALS (£)	**150,302,000**	**4,945,000**	**324,434,000**	**39,056,000**

EVERY BREATH COUNTS
With Negative Air Ionization

Just a few years ago it was established that the electrical properties (aero-ionization) of fresh uncontaminated air were a significant factor in human health and metabolism. So **Medion** developed and tested the **Airtone** range of negative ionizers.

During the last 4 years, Medion has sold thousands of these ionizers to sufferers of migraine and respiratory complaints, such as bronchitis, catarrh, asthma and hay fever — with remarkable success.

Medion has now entered the field of environmental control, producing ionizers for offices, conference rooms, clean rooms, restaurants, workshops and other large work areas.



EC.30 Environmental Model

Tests with these large-scale units have shown that **cross-infection is reduced, with a consequent curtailment of absenteeism.**

- * Concentration is improved
- * Efficiency is improved
- * Health is improved

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Estimates of Air Pollution in the United Kingdom in the year 1971/72

Table 1

Estimates of Pollution by Smoke and Oxides of Sulphur in Million Metric Tonnes from the Main Uses of Primary Forms of Energy
(*one metric tonne=0·9842 long ton*)

Estimates prepared by Albert Parker, CBE, DSc

Figures for quantities of forms of energy were derived from the Digest of United Kingdom Energy Statistics issued in 1972 by the Department of Trade and Industry

Form of Energy and Class of Consumer	*Quantity of Energy*	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miners' coal ...	15·2	0·47
Railways ...	0·1	small
Industrial and miscellaneous including collieries ...	17·2	0·05
	32·5	0·52
Sulphur oxides		
Coal		
Domestic, including miners' coal ...	15·2	0·29
Electricity power stations ...	68·9	1·99
Railways ...	0·1	small
Collieries ...	1·3	0·03
Industrial and miscellaneous ...	17·2	0·42
Coke ovens ...	20·5	0·09
Gas supply industry for gas making ...	1·1	0·01
Low temperature carbonization plants ...	2·5	0·01
Patent fuel plants ...	1·4	small
	128·2	2·84
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels ...	5·1	0·08
Industrial and miscellaneous ...	3·0	0·05
	8·1	0·13
Oil		
Domestic ...	3·0	0·02
Industrial and commercial ...	53·4	2·31
Gas supply industry ...	1·9	small
Road transport ...	20·1	0·05
Railways ...	1·1	0·02
Marine craft (inland) ...	1·4	0·04
	80·9	2·44
Sulphur oxides overall total ...		5·41
Hydro-electricity (coal equivalent) ...	1·8	
Nuclear-electricity (coal equivalent) ...	9·8	
Natural gas (coal equivalent) ...	26·2	
Total coal equivalent, including oil at 1 tonne=1·7 tonnes of coal and including petroleum gases ...	328·5	

The amount of 53·4 million tonnes of oil used in 1971-72 for industrial and commercial purposes is equivalent in heating value to about 90·8 million tonnes of coal, which if used for the same purposes would have produced about 0·27 million tonnes of smoke and about 2·3 million tonnes of oxides of sulphur. The overall total amount of 5·41 million tonnes of oxides of sulphur is 1·647 per cent of the total coal equivalent of 328·5 million tonnes.

Of the 53·4 million tonnes of oil 15·1 million tonnes was used for electricity generation.

Table 2

Estimates of Pollutants from Road Vehicles in the United Kingdom in the Year 1971-72 in Million Tonnes

Consumption of Motor Spirit	14·96 million tonnes
Consumption of Derv Fuel	5·19 million tonnes

Pollutant	*Petrol Engines*	*Diesel Engines*
Carbon monoxide	7·0	0·11
Hydrocarbons	0·36	0·022
Aldehydes	0·01	0·003
Oxides of nitrogen	0·24	0·08
Oxides of sulphur	0·015	0·03

The estimated quantity of carbon monoxide discharged into the air from the other industrial and domestic uses of all fuels in the year 1971-72 is about 9 million tonnes including about 3·5 million tonnes from domestic heating appliances. These discharges are above ground level whereas the discharges from road vehicles are at ground level.

Lead

The total amount of lead in the lead alkyl compounds added to the 14·96 million tonnes of motor spirit used in the United Kingdom in 1971-72 was about 10,800 tonnes. The lead would be converted to complex inorganic compounds and about one-third would be retained partly in the lubricating oil and partly in the exhaust system. This means that the amount of lead in the compounds discharged in the exhaust gases from petrol driven vehicles in 1971-72 was about 7,000 tonnes.

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SMOKE CONTROL AREAS

Programmes and Progress

The following lists contain the names of local authorities in the "Black areas" with (1) the target date for completion of their smoke control programme (2) the final acreage when completed (3) acreage in operation on 30 June, 1973 (4) total number of premises in operation on 30 June, 1973.

The figures have been compiled directly from information obtained from the local authority concerned. Final acreage and target dates may differ from last year, or not be given, because of local government re-organization. The figures are for the position at the 30 June, 1973—some authorities will have started, or increased, their smoke control since this date.

Bold type indicates completed programmes.

**Indicates figures at 30 June, 1972 as no returns were received.*

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.73*	*4* *Premises (In Oper.) 30.6.73*
NORTHERN				
Darlington C.B.	1983	6,775	1,072	4,869
Gateshead C.B.	1980	4,559	1,176	9,677
Hartlepool C.B.	1976	11,280	3,958	15,606
Newcastle-upon-Tyne C.B.	1977	11,401	5,786	36,275
South Shields C.B.	1981	4,877	908	8,529
Sunderland C.B.	1978	13,391	1,938	10,631
Teesside C.B.	1978/80	—	16,428	53,660
Tynemouth C.B.	1980	3,500	1,501	6,724
Jarrow B.	1974	1,820	187	1,274
Wallsend B.	1979	3,544	1,034	4,900
Blaydon U.D.	1977	9,325	564	2,460
Bolden U.D.	1976	7,344	5,655	5,681
Felling U.D.	1979	3,325	553	5,066
Gosforth U.D.	1977	1,739	211	1,308
Hebburn U.D.	1974	1,563	1,470	7,507
Hetton U.D.	—	—	—	—
Newburn U.D.	1980	4,648	1,035	7,321
Ryton U.D.	1981	5,145	—	—
Whickham U.D.	1977	6,100	2,130	6,914
NORTH WESTERN				
Birkenhead C.B.	1976	8,643	3,995	19,593
Blackburn C.B.	1978/79	8,080	3,536	15,742
Bolton C.B.	1983	5,041	3,246	25,852
Bootle C.B.	1978	3,329	1,763	9,967
Burnley C.B.	**1972**	**4,695**	**4,695**	**34,928**
Bury C.B.	1976	3,415	2,548	9,832
Dudley C.B.	1980	14,297	7,835	34,059
Leicester C.B.	1975	18,144	13,734	16,6987
Liverpool C.B.	1980	27,819	17,100	94,412
Manchester C.B.	1977	27,255	17,594	100,181
Oldham C.B.	1977/78	6,392	3,476	18,563
Preston C.B.	1979	6,357	2,651	22,085
Rochdale C.B.	1980	9,553	5,974	23,649
St. Helens C.B.	1975/76	8,088	4,052	11,125
Salford C.B.	**1972**	**5,202**	**5,202**	**52,512**
Stockport C.B.	1977	8,439	3,886	25,136
Wallasey C.B.	1974/75	5,961	5,499	30,013
Warrington C.B.	1973	4,600	4,320	25,778
Wigan C.B.	1975	5,083	2,562	13,333
Accrington B.	1980	4,418	1,801	5,937
Altrincham B.	1975	3,497	1,896	8,368
Ashton-under-Lyne B.	1976	4,146	3,267	12,334
Bebington B.	1975	6,000	2,650	12,737
Colne B.	1974	2,881	773	6,007
Darwen B.	1982	5,000	1,273	3,485
Dukinfield B.	—	1,725	1,552	5,180

North Western continued

	1 Target Date	2 Final Acreage	3 Acreage (In Oper.) 30.6.73	4 Premises (In Oper.) 30.6.73
Eccles B.	1974	3,417	2,901	13,391
Ellesmere Port B.	1977	4,000	3,127	11,680
Farnworth B.	1978	1,504	662	3,581
Heywood B.	1973	8,342	8,248	11,590
Hyde B.	1974	4,170	3,326	11,946
Leigh B.	—	6,359	4,143	9,703
Middleton B.	1981	5,170	2,654	10,005
Mossley B.	1979	2,000	54	589
Nelson B.	1974	2,056	1,602	11,916
Prestwich B.	1974	2,420	2,067	8,575
Radcliffe B.	—	4,915	2,394	6,522
Sale B.	**1972**	**3,628**	**3,628**	**20,920**
Stalybridge B.	1974	3,190	2,478	5,414
Stretford B.	**1972**	**2,582**	**2,582**	**18,220**
Swindon and Pendlebury B.	1976	3,363	1,479	7,169
Widnes B.	1975	4,346	2,775	10,652
Abram U.D.	—	1,984	—	—
Ashton-in-Makerfield U.D.	1982	6,265	—	—
Aspull U.D.	—	1,906	—	—
Atherton U.D.	1974	2,265	1,849	5,014
Audenshaw U.D.	1978	1,241	75	1,839
Blackrod U.D.	1973	2,392	1,426	1,315
Bowdon U.D.	—	—	—	—
Bredbury and Romily U.D.	1979	4,295	714	4,239
Brierfield U.D.	1975	807	717	2,298
Chadderton U.D.	**1969**	**3,014**	**3,014**	**11,994**
Cheadle and Gatley U.D.	**1968**	**5,303**	**5,303**	**22,491**
Church U.D.	**1971**	**308**	**308**	**1,783**
Clayton-le-Moors U.D.	1978	1,039	—	—
Crompton U.D.	1978	2,865	1,548	3,356
Denton U.D.	**1970**	**2,592**	**2,592**	**14,679**
Droylsden U.D.	1974	1,245	1,048	8,755
Failsworth U.D.	1973	1,663	1,283	6,637
Fulwood U.D.	1978	3,164	469	910
Golbourne U.D.	—	7,548	2,455	1,144
Great Harwood U.D.	1974	2,868	2,530	2,211
Haydock U.D.	—	—	—	—
Hindley U.D.	1979	2,162	225	1,518
Horwich U.D.	1976	3,254	824	1,670
Huyton-with-Roby U.D.	1985	3,054	1,485	8,331
Ince-in-Makerfield U.D.	—	—	—	—
Irlam U.D.	1974	4,717	4,555	6,284
Kearsley U.D.	1974	1,728	556	2,085
Kirkby U.D.	1975	2,072	1,947	15,135
Litherland U.D.	—	—	460	1,368
Little Lever U.D.	1975	808	140	365
Newton-le-Willows U.D.	—	—	153	534
Oswaldtwistle U.D.	1978	4,000	401	1,318
Padiham U.D.	1974	976	863	3,199
Prescot U.D.	—	875	124	1,141
Rishton U.D.	—	—	109	313
Royton U.D.	**1972**	**2,149**	**2,149**	**7,626**
Runcorn U.D.	1975	7,212	3,392	11,197
Tottington U.D.	1975	2,544	1,087	2,497
Tyldesley U.D.	1978	5,174	1,422	2,681
Urmston U.D.	1973	3,799	3,441	16,611
Westhoughton U.D.	1980	5,554	1,641	2,520
Whitefield U.D.	**1968**	**3,386**	**3,386**	**7,610**
Worsley U.D.	1975	7,242	3,650	12,215

YORKSHIRE AND HUMBERSIDE

Barnsley C.B.	1980	7,817	1,954	3,680
Bradford C.B.	1974	25,504	19,682	89,943
Dewsbury C.B.	1976	6,720	5,488	15,231

Yorkshire and Humberside continued

	1 Target Date	2 Final Acreage	3 Acreage (In Oper.) 30.6.73	4 Premises (In Oper.) 30.6.73
Doncaster C.B.	1975	8,371	5,950	22,916
Halifax C.B.	1978	14,081	3,874	24,000
Huddersfield C.B.	1980	14,147	6,309	29,344
Kingston Upon Hull C.B.	1984	17,599	7,916	35,480
Leeds C.B.	1975	40,613	25,390	111,921
Rotherham C.B.	1975	8,000	3,027	14,000
Sheffield C.B.	**1972**	**45,363**	**45,363**	**189,000**
Wakefield C.B.	1977	5,801	2,804	7,977
Batley B.	1977	4,457	1,102	5,283
Brighouse B.	1973	7,873	7,500	12,968
Castleford B.	—	4,394	32	507
Keighley B.	1974	23,611	8,444	16,950
Morley B.	1977	9,494	6,215	9,600
Ossett B.	**1968**	**3,332**	**3,332**	**6,362**
Pontefract B.	1983	4,965	981	2,153
Pudsey B.	1973	5,323	3,917	9,528
Spenborough B.	**1973**	**8,253**	**8,253**	**15,900**
Aireborough U.D.	**1971**	**6,856**	**6,856**	**12,040**
Baildon U.D.	**1972**	**2,830**	**2,830**	**6,325**
Bingley U.D.	**1970**	**11,418**	**11,418**	**11,263**
Conisborough U.D.	—	—	144	500
Cudworth U.D.	—	1,748	123	436
Darfield U.D.	—	2,018	—	—
Darton U.D.	1989	4,718	544	800
Dearne U.D.	1987	3,888	1,423	1,965
Dodworth U.D.	—	—	—	—
Elland U.D.	1973	5,951	5,549	4,821
Featherstone U.D.	—	4,425	—	—
Heckmondwike U.D.	1974	697	546	2,855
Horbury U.D.	**1971**	**1,280**	**1,280**	**3,914**
Horsforth U.D.	1975	2,706	1,694	5,470
Hoyland Nether U.D.	1980	1,998	301	880
Knottingley U.D.	1973	2,837	1,042	3,592
Mexborough U.D.	1980	1,452	248	748
Mirfield U.D.	1979	3,394	1,172	3,513
Normanton U.D.	1989	3,061	56	154
Queensbury and Shelf U.D.	—	2,795	625	2,097
Rawmarsh U.D.	—	—	16	40
Rothwell U.D.	1974	10,695	4,260	6,148
Royston U.D.	1975	1,452	64	368
Shipley U.D.	**1971**	**2,184**	**2,184**	**10,494**
Sowerby Bridge U.D.	1974	5,763	1,973	3,732
Stanley U.D.	1976	4,466	1,457	2,574
Swinton U.D.	—	1,718	850	2,393
Wath-upon-Dearne U.D.	1974	2,665	898	1,836
Wombwell U.D.	1982	3,838	306	418
Worsborough U.D.	—	—	—	—

EAST MIDLANDS

	1 Target Date	2 Final Acreage	3 Acreage (In Oper.) 30.6.73	4 Premises (In Oper.) 30.6.73
Derby C.B.	1979	19,282	10,094	32,611
Nottingham C.B.	1975	18,364	7,568	26,729
Chesterfield B.	1980	8,468	1,400	6,455
Ilkeston B.	1984	3,017	1,382	4,762
Mansfield B.	1981	7,009	3,321	10,046
Alfreton U.D.	—	4,957	677	175
Arnold U.D.	1978	4,505	941	4,470
Beeston and Stapleford U.D.	1974	5,564	5,318	18,944
Bolsover U.D.	—	—	86	273
Dronfield U.D.	1974	3,457	2,453	4,722
Eastwood U.D.	—	—	—	—
Hucknall U.D.	—	4,029	1,918	2,000
Kirkby-in-Ashfield U.D.	1980	5,831	2,079	1,942
Long Eaton U.D.	—	3,557	37	448
Mansfield Woodhouse U.D.	1987	4,834	1,893	1,861
Staveley U.D.	1976	6,504	252	838
Sutton-in-Ashfield U.D.	—	10,507	4,725	5,450
West Bridgeford U.D.	1977	3,044	321	1,204

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.72*	*4* *Premises (In Oper.) 30.6.72*
GREATER LONDON				
City of London	**1955**	**677**	**677**	**21,700**
Barking	1977	10,788	5,794	44,485
Barnet	1976	22,123	12,253	75,846
Bexley	1975	15,896	11,120	56,700
Brent	1973	11,012	8,801	81,805
Bromley	1977	37,583	15,466	66,261
Camden	**1968**	**5,364**	**5,364**	**87,303**
Croydon	1978	21,395	10,864	86,859
Ealing	**1972**	**13,708**	**13,708**	**91,057**
Enfield	1975	20,061	16,820	74,250
Greenwich	**1972**	**11,724**	**11,724**	**75,673**
Hackney	**1967**	**4,814**	**4,814**	**90,507**
Hammersmith	**1967**	**3,950**	**3,950**	**72,559**
Haringey	**1968**	**7,491**	**7,491**	**84,683**
Harrow	1975	12,555	9,344	51,407
Havering	1976	29,650	11,068	39,754
Hillingdon	1978	27,258	15,558	48,026
Hounslow	**1972**	**14,469**	**14,469**	**73,646**
Islington	**1969**	**3,679**	**3,679**	**82,000**
Kensington and Chelsea (Royal)	**1972**	**2,950**	**2,950**	**75,288**
Kingston-upon-Thames (Royal)	1977	9,281	4,776	34,586
Lambeth	1976	6,726	4,947	85,641
Lewisham	1975	8,579	7,475	77,624
Merton	1975	9,381	7,294	47,800
Newham	1977	8,986	2,818	39,292
Redbridge	**1971**	**13,983**	**13,983**	**67,658**
Richmond-upon-Thames	**1972**	**13,873**	**13,873**	**75,400**
Southwark	1975/76	6,981	5,082	77,793
Sutton	1976	10,732	5,827	40,998
Tower Hamlets	**1968**	**4,876**	**4,876**	**78,702**
Waltham Forest	1980	9,805	6,695	60,009
Wandsworth	1975	8,977	7,471	88,441
Westminster (City)	**1970**	**5,334**	**5,334**	**131,021**
WEST MIDLANDS				
Birmingham C.B.	1978	51,598	32,505	192,910
Coventry C.B.	1982	20,200	6,464	25,184
Solihull C.B.	1989	13,645	3,162	9,975
Stoke-on-Trent C.B.	1980	22,949	10,036	27,018
Walsall C.B.	1978	12,990	3,747	12,293
Warley C.B.	1989	9,471	1,781	14,358
West Bromwich C.B.	1980	11,704	3,387	18,355
Wolverhampton C.B.	1986	17,004	4,913	27,538
Halesowen C.B.	1975	5,237	3,627	12,138
Newcastle-under-Lyme B.	1984	8,861	3,237	10,505
Nuneaton B.	1981	11,700	2,826	6,000
Stourbridge B.	—	4,631	2,677	9,716
Sutton Coldfield B.	1979	13,691	2,356	10,279
Aldridge-Brownhills U.D.	—	—	3,590	12,400
Bedworth U.D.	1980	7,820	2,271	4,240
Kidsgrove U.D.	1979/80	4,137	715	1,893
SOUTH WESTERN				
Bristol C.B.	1981	27,068	7,519	28,697
Local Authorities outside the Black Areas who have started Smoke Control				
Bath C.B.	1990	7,000	—	—
Brighton C.B.	1989	14,613	—	—
Burton on Trent C.B.	1978	4,222	470	2,786
Canterbury C.B.	—	4,810	200	700
Exeter C.B.	1982	10,952	5,297	10,677

Local Authorities outside the Black Areas who have started Smoke Control continued

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.72*	*4* *Premises (In Oper.) 30.6.72*
Lincoln C.B.	—	8,828	2,441	2,920
Luton C.B.	1980	10,695	4,358	22,665
Northampton C.B.	1983	19,181	5,538	3,236
Norwich C.B.	—	9,655	1,435	1,172
Oxford C.B.	1985	8,785	2,261	9,956
Portsmouth C.B.	1988	9,249	—	—
Reading C.B.	1985	9,106	3,007	13,719
Southampton C.B.	1985	12,059	2,078	12,900
Southport C.B.	1990	9,426	67	124
Worcester C.B.	1984	6,114	—	—
York C.B.	1980	7,295	301	2,530
Aylesbury B.	1978	3,594	275	1,894
Bedford B.	1980	6,012	2,469	11,432
Cambridge B.	1984	10,060	407	1,453
Cheltenham B.	—	—	861	2,191
Chatham B.	1980	4,371	3,201	7,500
Dartford B.	1976	4,292	3,202	13,068
Gillingham B.	—	11,123	8,313	13,522
Glossop B.	1978	3,324	1,000	2,320
Grantham B.	—	3,868	1,505	41,848
Gravesend B.	1981	4,619	1,626	5,901
Guildford B.	1984	7,184	—	—
Harrogate B.	1978	8,320	160	524
Hemel Hempstead B.	—	7,193	3,131	—
High Wycombe B.	1978	7,091	3,652	14,989
King's Lynn B.	—	499	425	2,050
Lancaster B.	—	5,413	3,184	7,650
Leamington Spa (Royal) B.	1978	2,875	1,151	6,525
Lichfield B.	1978	3,928	—	—
*New Windsor (Royal) B.	1980	4,616	415	1,082
Peterborough B.	—	10,002	2,795	3,667
Rawtenstall B.	1985	9,528	653	808
Rochester B.	—	4,506	3,183	12,553
Rugby B.	1984	7,010	3,481	9,947
Scunthorpe B.	1978/79	6,000	3,528	14,870
Shrewsbury B.	—	9,317	379	2,499
Slough B.	1978	6,202	3,320	16,830
Stafford B.	1982	5,089	—	—
Stamford B.	1980	1,918	—	—
Tamworth B.	1980	7,647	2,753	6,724
Todmorden B.	—	12,790	948	5,791
Warwick B.	—	—	147	970
Watford B.	1979	5,275	2,003	8,432
Whitley Bay B.	1976	3,612	1,941	5,954
Workington B.	1982	5,644	17	389
Basildon U.D.	1977	—	4,528	20,888
Brentwood U.D.	—	—	227	2,856
Cheshunt U.D.	1980	8,480	1,901	8,063
Corby U.D.	1982	3,776	1,136	7,600
Crawley U.D.	**1972**	**5,614**	**5,614**	**22,871**
Hale U.D.	1978	2,264	178	1,625
Harlow U.D.	**1966**	**5,889**	**5,889**	**23,977**
Hazel Grove and Bramhall U.D.	1974	5,990	2,863	13,799
Heanor U.D.	—	—	142	861
*Kingswood U.D.	—	—	12	130
Leek U.D.	—	—	96	229
Letchworth U.D.	—	4,854	1,103	3,401
Marple U.D.	1978	7,130	1,533	2,769
Northfleet U.D.	—	—	377	2,500
Old Fletton U.D.	—	—	134	1,060
Potters Bar U.D.	1981	—	1,415	3,777
Ramsbottom U.D.	1975	9,559	1,674	3,802
Ripley U.D.	—	—	19	548
Saddleworth U.D.	1973	800	226	400
Saltburn and Marske-by-the-Sea U.D.	1974	3,686	2,831	3,009
Seaton Valley U.D.	1977	13,659	1,960	3,912
Skelmersdale and Holland U.D.	—	7,537	3,169	6,581

Local Authorities outside the Black Areas who have started Smoke Control continued	*1* *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.72*	*4* *Premises (In Oper.) 30.6.72*
Skipton U.D.	1975	4,410	1,859	3,147
Staines U.D.	**1972**	**8,271**	**8,271**	**23,720**
Stanley (Co. Durham) U.D.	—	12,650	472	1,845
Stocksbridge U.D.	1977	4,631	205	409
Swadlincote U.D.	1978	3,754	1,314	1,443
Thurrock U.D.	1980	35,000	5,168	13,685
Waltham Holy Cross U.D.	1977/78	1,077	299	1,230
Wellington (Salop) U.D.	1977	2,281	197	984
Wilmslow U.D.	1984	7,691	293	2,588
Winsford U.D.	—	7,094	708	3,857
Belper R.D.	1974	847	726	179
Blaby R.D.	—	—	1,128	3,269
Blackburn R.D.	—	—	748	2,167
Castleward (Northumberland) R.D.	**1972**	**306**	**306**	**3,238**
Chesterfield R.D.	—	—	13,060	14,593
Darlington R.D.	1976	12,000	1,006	4,808
Dartford R.D.	—	—	1,341	3,824
Easington R.D.	1977	1,440	610	3,483
Easthampstead R.D.	1975	3,286	180	1,086
Elstree R.D.	—	—	500	2,877
Flaxton R.D.	**1969**	**237**	**237**	**270**
Glanford Brigg R.D.	—	—	1,526	489
Market Drayton R.D.	1979	800	209	530
Meriden R.D.	1975	3,624	2,875	23,688
Runcorn R.D.	1977	9,273	1,131	2,922
*S. E. Derbyshire R.D.	—	—	11	122
Seisdon R.D.	1986	6,000	1,166	794
Skipton R.D.	1983	737	54	464
Warrington R.D.	1974	22,722	5,155	8,976
Weatherby, R. D.	—	—	100	750
Whiston R.D.	—	3,297	2,012	11,173
Wortley R.D.	—	—	1,395	5,135

WALES

Cardiff C.B.	*Mainly low volatile steam coal used*			
Merthyr Tydfil C.B.	—	—	—	—
Newport C.B.	—	—	43	622
Swansea C.B.	*Mainly low volatile steam coal used*			
Neath B.	—	—	—	—
Port Talbot B.	—	—	—	—
Rhondda B.	—	—	—	—
Abercarn U.D.	—	—	—	—
Aberdare U.D.	—	—	—	—
Abertillery U.D.	—	—	—	—
Bedwas and Machen U.D.	—	—	—	—
Bedwellty U.D.	—	—	—	—
Blaenavon U.D.	—	—	—	—
Caerleon U.D.	—	—	—	—
Caerphilly U.D.	—	—	—	—
Cwmbran U.D.	—	—	—	—
Ebbw Vale U.D.	—	—	—	—
Gelligaer U.D.	—	—	—	—
Glyncorrwg U.D.	—	—	—	—
Llwchwr U.D.	—	—	—	—
Maesteg U.D.	—	—	—	—
Mountain Ash U.D.	—	—	—	—
Mynyddisbwyn U.D.	—	—	—	—
Nantyglo and Blaina U.D.	—	—	—	—
Ogmore and Garw U.D.	—	—	—	—
Pontypool U.D.	—	—	—	—
Pontypridd U.D.	—	—	—	—

Wales continued

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.73*	4 *Premises (In Oper.) 30.6.73*
Rhymney U.D.	—	—	—	—
Risca U.D.	—	—	—	—
Tredegar U.D.	—	—	—	—

Outside Black Area (Wales)

	1	2	3	4
Wrexham B.	1979	2,916	863	3,942
*Connah's Quay U.D.	—	—	53	—
*Mold U.D.	—	1,160	108	450

SCOTLAND—Smoke Control Areas in Operation

	1	2	3	4
Airdrie	1984	2,909	99	499
Alloa	1976	1,355	272	1,134
Barrhead	1975	1,154	916	5,062
Bearsden	**1973**	**3,078**	**3,078**	**8,080**
Bishopsbriggs	1975	3,595	887	2,400
Clackmannan County	1976	2,095	370	1,997
Clydebank	1975	2,980	2,177	12,545
Coatbridge	**1970**	**4,339**	**4,339**	**15,800**
Denny and Dunipace	—	906	113	714
Dumbarton Burgh	1974	3,420	1,730	6,231
Dundee	1979	12,855	6,747	42,428
East Kilbride	**1972**	**6,658**	**6,658**	**19,920**
Edinburgh	1982	34,781	9,645	40,217
Falkirk	1975	4,825	3,540	10,266
Fife County	—	—	5,732	4,819
Galashiels	**1972**	**1,766**	**1,766**	**4,919**
Glasgow	1979	39,725	27,163	186,749
Grangemouth	1980	4,797	673	4,632
Hamilton	1980	3,817	907	6,023
Hawick	1982	1,240	14	116
Johnstone	—	—	243	1,353
Kilmarnock	**1972**	**77**	**77**	**304**
Lanark County	—	—	1,572	10,276
*Midlothian County	—	—	4,137	4,704
Milngavie	1974	1,848	553	1,148
Motherwell	—	6,987	773	3,364
Paisley	1975	6,558	5,432	27,795
Port Glasgow	1973	1,461	1,275	6,128
Renfrew Burgh	1973	2,315	2,199	6,833
Rutherglen	1976	1,229	644	4,479
*Stirling County	1976	—	5,792	12,347
West Lothian County	—	69,959	2,382	11

NORTHERN IRELAND—Smoke Control Areas in Operation

	1	2	3	4
Antrim R.D.	—	—	682	2,748
Armagh U.D.	1980	2,400	579	2,984
*Ballymena B.	—	—	—	—
Belfast C.B.	1989	15,815	1,368	12,792
Castlereagh R.D.	1976	—	3,060	11,290
*Coleraine R.D.	—	—	—	—
Craigavon U.D.	1980	3,641	—	2,706
Downpatrick U.D.	—	—	482	600
Hillsborough R.D.	1977	—	577	1,680
Holywood U.D.	1977	—	176	765
Larne B.	1976	2,381	11	290
Londonderry Dev. Comm.	—	—	74	546
*Lurgan B.	1980	2,400	579	2,984
Newtownabbey U.D.	1984	—	1,489	3,721
Newtownards B.	1976	243	105	594
*Portadown B.	—	—	85	613

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 30th June 1973

(*Figures supplied by the Department of the Environment*)

(*1*) Region	(*2*) *No. of black area acres covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(*3*) *Percentage* of total black area acreage in region covered*	(*4*) *No. of black area premises covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(*5*) *Percentage* of total black area premises in the region*
Northern	62,587	49·9	260,836	47·2
Yorks & Humberside ...	260,506	69·2	823,538	70·5
East Midlands	86,514	32·2	261,315	51·1
Greater London	294,651	90·1	2,441,879	92·5
North West	241,102	60·1	1,019,032	59·8
West Midlands	106,598	42·8	484,561	46·1
South West	11,231	42·6	41,278	27·7
Total (black areas)	1,063,189	59·9	5,332,439	68·6
Outside black areas... ...	189,736		500,347	
Grand Totals...	**1,252,925**		**5,832,786**	

*The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke control orders (e.g.: there may be some areas of open country).

Major Smog Disasters

The word "smog" was first used by the late Dr. H. A. Des Vœux, founder, president of the N.S.A.S. in 1905, to denote the combination of smoke and natural fog that in urban areas may have disastrous consequences. There are numerous cases of smog conditions resulting in a marked rise in mortality and morbidity from respiratory disorders and consequential cardiac failure. Among these incidents are the following:

London, 1873. Rise in bronchitis deaths, compared with the previous week, of 268.

London, 1880. Rise in bronchitis deaths, compared with the previous week, of 692.

London, 1891. Rise in bronchitis deaths, compared with the previous week, of 572.

Glasgow, 1909. Average number of deaths in the three weeks prior to the fog were 57 per week. During five weeks of fog or haze the deaths per week were: 138, 233, 171, 198 and 137.

Manchester and Salford, 1930-31. In December, with no fog, there were 137 respiratory disease deaths. In January there were nine days heavy fog and 592 deaths.

Meuse Valley, 1930. 60 deaths attributed to fog, the death rate rising to 10·5 times the normal. Many cattle had to be slaughtered.

London, 1948. Bronchitis deaths in week before fog, 73; in the week of fog, 148.

Donora, U.S.A., 1948. 18 deaths in a population of 14,000. 42 per cent of the population were estimated to have suffered from illness.

London, 1952. The fog developed on Friday, 5 December and continued until 8 December. Estimated total of 4,000 deaths in the Greater London area. In the Administrative County only deaths from bronchitis rose from 121 to 872, and from heart and circulatory diseases, from 318 to 801.

London, 1956. 1,000 additional deaths attributed to January fog in the Greater London area. (*B.M.J.,* 31 March, 1956.)

London, 1962. Fog in London and other areas, December 3-7, with similarities to the 1952 fog, but with 750 additional deaths as compared with 4,000.

Principal References

Mortality and Morbidity during the London Fog of December, 1952. Ministry of Health Public Health Report No. 95. (This report contains a section on "Previous Fog Incidents", with a statistical appendix for those in London.)

Les Problèmes de Pollution de l'Atmosphère, Batta, Firket and Leclerc, Liège, 1937.

Air Pollution in Donora, Pa. Public Health Bulletin, No. 306, Federal Security Agency, Public Health Service, Washington.

AN OUTLINE OF THE LAW RELATING TO AIR POLLUTION

The control of air pollution in Great Britain is essentially a team effort involving Local Authorities, the Department of the Environment (including the Alkali Inspectorate), Police Authorities (in respect of road vehicle emissions) and the Factory Inspectorate (in respect of dusts and toxic fumes, etc., in factory atmospheres).

The principal legislation enforced by local authorities in Great Britain (excluding Northern Ireland) is contained in the Clean Air Acts 1956 and 1968, but some of the "nuisance" provisions of the Public Health Act 1936, extended and amended by the Public Health Act 1961 and the Public Health (Recurring Nuisances) Act 1969, are applicable in specified circumstances. The domestic smoke control area provisions of the Clean Air Act 1956 were amended by section 95 of the Housing Act 1964 and further amended by the Clean Air Act 1968.

The provisions of the Clean Air (Northern Ireland) Act of 1964 are largely identical to those of the 1956 Act.

The control of "noxious or offensive gases" from some 59 different classes of works registrable under the provisions of the Alkali &c. Works Regulation Act 1906 and the Alkali &c. Works Order 1966 is exercised by the Alkali Inspectorate of the Department of the Environment (see the section on page 40 on the Alkali &c. Works Regulation Act).

Action may also be taken under Common Law procedure by anyone who suffers nuisance from air pollution, and in this way it may be possible to secure damages and/or to obtain an injunction.

There are also a number of Private Acts of Parliament in which some local authorities possess powers to deal with smoke emission, to establish smokeless zones and to grant optional prior approval of proposed new industrial fuel burning installations. Most of these provisions, although they may remain in force, have now been superseded by the provisions of the Clean Air Acts 1956 and 1968. The control of pollution from road vehicles is exercised by the police under the provisions of the Road Traffic Acts and the Motor Vehicles (Construction and Use) Regulations 1969, a note of which is to be found on a later page.

The following outline of current legislation, which necessarily omits much detail, gives the main provisions of the Clean Air Acts 1956 and 1968 and supporting Acts under the main subjects of "smoke", "chimney heights", "grit, dust and fume" and "miscellaneous provisions".

1. THE CONTROL OF SMOKE

A Definition of "dark" and "black" smoke:

Where legal standards of emission are prescribed for smoke, they refer to "dark" and "black" smoke. These are defined in the 1956 Act, and in Regulations, by reference to a shade on the British Standard Ringelmann Chart (see page 45) as:

"Dark" smoke (defined in S.34 of the 1956 Act) means smoke which if compared . . . with the Ringelmann Chart would appear to be as dark as or darker than shade 2 on the chart.

"Black" smoke (defined in the Dark Smoke (Permitted Periods) Regulations 1958; and in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 means smoke which, if compared . . . with the Ringelmann Chart, would appear to be as dark as or darker than shade 4 on the chart.

B Use of Aids in Assessing Smoke Colour:

Although legislation defines dark and black smoke by reference to colour shades on the Ringelmann Chart, the use of the Chart is not compulsory. S.34(2) of the 1956 Act says that "For the avoidance of doubt, it is hereby declared that . . . the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type."

C Design Standards for New Plant

Section 3 of the Clean Air Act 1956 requires all new furnaces (other than domestic boilers with a rating less than 55,000 Btu/hr.) to be, so far as practicable, capable of operating continuously without emitting smoke when burning fuel of a type for which the furnace was designed.

There is no definition of "furnace", but a practical interpretation of this word wherever it appears in Clean Air legislation, is usually taken as "any enclosed or partly enclosed space in which liquid, solid or gaseous matter is burned, or in which heat is produced".

It is a requirement of this section that the proposed installation of all new furnaces (other than domestic boilers rated at less than 55,000 Btu/hr.) *must* be notified to the local authority, and if one wishes to do so, one may apply for local authority approval that the proposed unit is capable of substantially smokeless operation. The approval does not, however, allow indiscriminate smoke emission and the furnace must be operated to ensure that permissible emissions are not exceeded.

D Standards for Smoke Emission:

Section one of the Clean Air Act 1956 prohibits the emission of dark smoke from a chimney, but also allows the Secretary of State for the Environment to make regulations exempting prescribed lengths of emission from possible action under this section.

The "permitted emissions" are prescribed in the Dark Smoke (Permitted Periods) Regulation 1958: and the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958.

D(1) The Dark Smoke (Permitted Periods) Regulations 1958 (Statutory Instrument 1958 No. 498)

(*a*) **Aggregate emissions of dark smoke.**

Number of furnaces served by the chimney	*Permitted emission of dark smoke in any period of eight hours*	
	If not soot blowing during period	*If soot blowing during period*
One	10 mins.	14 mins.
Two	18 mins.	25 mins.
Three	24 mins.	34 mins.
Four or more	29 mins.	41 mins.

Where a single boiler or unit of industrial plant is fired by more than one furnace discharging into the same chimney, those furnaces shall be deemed to be one furnace.

(*b*) **Continuous emissions of dark smoke**

The continuous emission of dark smoke in excess of four minutes, caused otherwise than by soot blowing, is prohibited.

(*c*) **Aggregate emission of black smoke**

No emission of black smoke exceeding two minutes aggregate in any period of thirty minutes is allowed.

There are thus three standards of emission which are acceptable in relation to any one chimney. The penalty for an offence under section one of the Act is a fine not exceeding £100 for each day on which the offence occurs.

D(2) The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (Statutory Instrument 1958 No. 878)

By the provisions of section 20 of the 1956 Act, vessels in waters not navigable by sea-going ships and in certain waters within the seaward limits of the territorial waters of the United Kingdom, must comply with the dark smoke provisions of section one of the 1956 Act, subject to the permitted emissions contained in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958, as follows:—

Class of Case	*Permitted Period for Emission of Dark Smoke*
1. Emissions from a forced draught oil-fired boiler furnace, or an oil engine.	10 minutes in the aggregate in any period of 2 hours.
2. Emission from a natural draught oil-fired boiler furnace (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
3. Emissions from a coal-fired boiler furnace:—	
(*a*) when the vessel is not under way (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
(*b*) when the vessel is under way.	20 minutes in the aggregate in any period of one hour.
4. Emissions from a natural draught oil-fired boiler furnace or a coal-fired boiler furnace in the following cases:—	
(*a*) a vessel with funnels shortened for the purpose of navigating the Manchester Ship Canal; (*b*) a tug not under way, but preparing to get under way or supplying power to other vessels or to shore installations; (*c*) a vessel not under way but using main power for the purpose of dredging, lifting, pumping or performing some other special operation for which the vessel is designed.	20 minutes in the aggregate in any period of one hour.
5. Emissions from any other source.	5 minutes in the aggregate in any period of 1 hour.

A vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground shall be deemed to be under way. The Regulations include a proviso that:

(*a*) **continuous emissions of dark smoke caused otherwise than by the soot blowing of a water tube boiler shall not exceed**

(i) in the case of classes 1 and 2, 4 minutes;
(ii) in the case of natural draught oil-fired boiler furnaces in class 4, 10 minutes; and
(iii) in no case shall black smoke be emitted for more than 3 minutes in the aggregate in any period of 30 minutes.

D(3) Defences for excessive dark and black smoke emission

Section one of the 1956 Act contains three defences which may be available if an occupier of premises is proceeded against for dark/black smoke emission. These briefly are that the emission was:—

(*a*) solely due to lighting a furnace from cold and all practicable steps had been taken to minimise emissions.
(*b*) solely due to unavoidable mechanical failure of part of the plant and the contravention could not have been prevented after failure occurred.
(*c*) solely due to the unavoidable use of unsuitable fuel, suitable fuel not being available and the best available fuel being used; and all practicable steps were taken to minimise the emission.
(*d*) due to any combination of (*a*), (*b*) and (*c*).

N.B. That these are not absolute defences and are available only if every practical effort is made to avoid and/or minimise emissions.

E **Emissions of Dark Smoke from "Bonfires", etc.**

On 1st October 1969 Section one of the Clean Air Act 1968 became operative. This section prohibits (subject to prescribed exemptions) the emission of dark smoke from industrial or trade premises (as distinct from chimneys) and is concerned mainly with preventing excessive smoke emission caused by the indiscriminate burning of industrial or trade refuse in the open, but this section will also control dark smoke emissions from industrial processes not having a chimney.

In this connection, "industrial or trade premises" means premises normally used for industrial or trade purposes, or premises not normally so used, but which, at the time of the offence, were being used for industrial or trade burning.

The Secretary of State has made the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 which exempt the emission of dark smoke caused by the burning of the following materials, subject to the specified conditions:—

Exempted Matter

(1) *Matter*	(2) *Conditions*
1. Timber and any other waste matter (other than natural or synthetic rubber or flock or feathers) which results from the demolition of a building or clearance of a site in connection with any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961).	Conditions A, B and C.
2. Explosive (within the meaning of the Explosives Act 1875) which has become waste; and matter which has been contaminated by such explosive.	Conditions A and C.
3. Matter which is burnt in connection with (*a*) research into the cause or control of fire or (*b*) training in fire fighting.	Condition C.
4. Tar, pitch, asphalte and other matter which is burnt in connection with the preparation and laying of any surface, or which is burnt off any surface in connection with resurfacing, together with any fuel used for any such purpose.	Condition C.
5. Carcases of animals or poultry which (*a*) have died, or are reasonably believed to have died, because of disease; (*b*) have been slaughtered because of disease; or (*c*) have been required to be slaughtered pursuant to the Diseases of Animals Act 1950.	Conditions A and C, unless the burning is carried out by or on behalf of an inspector (within the meaning of Section 84 of the Diseases of Animals Act 1950).
6. Containers which are contaminated by any pesticide or by any toxic substance used for veterinary or agricultural purposes; and in this paragraph "container" includes any sack, box, package or receptacle of any kind.	Conditions A, B and C.

The conditions referred to in column 2 are:—

CONDITION A That there is no other reasonably safe and practicable method of disposing of the matter.
CONDITION B That the burning is carried out in such a manner as to minimise the emission of dark smoke.
CONDITION C That the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on his behalf.

F **Smoke Control Areas:**

Sections 11 to 15 of the Clean Air Act 1956, Sections 8 to 10 of the 1968 Act and Section 95 of the Housing Act 1964 relate to Smoke Control Areas, the administrative procedures, and the enforcement of Smoke Control Orders.

Section 11 of the 1956 Act allows a Local Authority to make a Smoke Control Order which must be submitted to the Secretary of State of the Environment for confirmation. When operative it is an offence for an occupier of premises to allow smoke emission from a chimney, unless the smoke is caused by the use of an "authorised fuel"; or the "fireplace" which the chimney serves is exempt from the Order.

The Clean Air (Authorised Fuels) Regulations 1956, 1963, 1965, 1969, 1970 (No. 2), 1971, 1971 (No. 2), 1971 (No. 3) and 1971 (No. 4) allow the use of the following fuels in Smoke Control Areas, even though some may for short periods cause light smoke emission:—

Anthracite	
Low Volatile Steam Coal	
Phurnacite Ovoids	Manufactured solid smokeless fuels
Coalite, Rexco and Rexco Ovoids	
Gloco and Gas Coke	
Homefire and Roomheat	
Multiheat	
Sunbrite and 'hard' coke	
Cosiglow	
Maxiglow	
Fireglo briquettes	
Ancit briquettes	
Extracite ovoids	
Syntraciet ovoids	
XL briquettes	
Anthracine ovoids	
Anthrite ovoids	
Gas and Electricity	

Other solid fuels are at various times submitted to the Department of the Environment for testing to determine whether or not they might become "Authorised Fuels" for use in Smoke Control Areas.

The Smoke Control Areas (Exempted Fireplaces) Orders 1970, 1970 No. 2, 1971, 1972 and 1972 (No. 2) conditionally exempt the emission of smoke from chimneys serving the following fireplaces:—

Class of Fireplace	*Conditions*
A. **1970 Order**	
1. Any fireplace specially designed or adapted for combustion of liquid fuel.	
2. Any fireplace (other than a fireplace fired by pulverised fuel) constructed on or after 31st December 1956 and installed before 1st May 1970 and equipped with mechanical stokers, or adapted between those dates for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
3. Any fireplace designed to burn coal (other than a fireplace fired by pulverised coal) with a heating capacity exceeding 150,000 Btu/hr. constructed and installed on or after 31st December 1956 and equipped with mechanical stokers or adapted on or after that date for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
4. The fireplace known as the Solid Fuel Ductair Unit, manufactured by Radiation Limited.	
5. The fireplace known as the Fulgora Slow Combustion Stove, manufactured by Fulgora Stoves Limited.	No fuel shall be used other than wood waste in clean condition.
6. The fireplace known as the Housewarmer, manufactured for the National Coal Board by Ideal Standard Limited.	No fuel shall be used other than washed coal singles.
7. The fireplace known as the Wood Chip Fired Air Heater, manufactured by Air Plants Ltd.	No fuel shall be used other than clean wood waste of a size within the limits referred to in the manufacturer's instructions.
8. The fireplace known as the Hounsell Sawdust Burning Stove, manufactured by John Hounsell (Engineers) Limited.	No fuel shall be used other than wood waste in clean condition.
B. **1970 (No. 2) Order (S.I. 1970 No. 1667)** The fireplace known as the Triancomatic T.80.	No fuel shall be used other than selected washed coal singles.
C. **1971 Order (S.I. 1971 No. 1265)** The fireplace known as the Rayburn CB34.	No fuel shall be used other than selected washed coal singles.
D. **1972 Order (S.I. 1972 No. 438)** The fireplace known as the Parkray Coalmaster.	No fuel shall be used other than selected washed coal singles.
E. **1972 (No. 2) Order (S.I. 1972 No. 955)** The fireplace known as the Trianco TGB 17.	No fuel shall be used other than selected washed coal singles.

In addition to the conditions above two standard conditions require all appliances to be installed, maintained and operated
(i) so as to minimise the emission of smoke;
(ii) in accordance with the manufacturer's instructions as to the operation (if any) of the appliance or, in the case of the class of fireplace numbered 6 above, in accordance with such instructions of the National Coal Board.

The local authority may also include in the Smoke Control Order other exemptions, which they may feel are necessary, subject to reasonable conditions. One of these is to allow the lighting of domestic fires with sticks and paper if there is no gas in the dwelling.

Thus, coal, oil and waste wood may not normally be burnt either by a householder or an industrialist unless on an exempted appliance, the design of which has satisfied the Secretary of State that it is capable of being operated substantially smokelessly and is exempted by Statutory Instrument.

The 1968 Act extended the Smoke Control provisions of the 1956 Act. The Minister is now empowered to require a local authority to make Smoke Control Orders. It is also an offence to acquire or to sell by retail for delivery in a Smoke Control Area any fuel other than an authorised fuel, unless in each case the premises or fireplace are exempt.

The financial provisions of the 1956 Act require the local authority to pay to owners or occupiers of dwelling houses a grant of 7/10ths of the reasonable cost of fireplace adaptations, and they may repay all or any part of the remaining 3/10ths. The local authority recovers 4/7ths of the grant from the Exchequer. A grant is not available in respect of a "new dwelling" begun on or after 16th August 1964.

The Housing Act 1964 allows a local authority to "designate" as unsuitable any appliances for which suitable fuels are not fully available, and in those circumstances a grant is not available for installation of those appliances.

Section 10 of the 1968 Act prevents a local authority from postponing the operation of a Smoke Control Order by more than 12 months.

Grant Arrangements

The principles which local authorities must follow in assessing eligibility of works of adaptation for grant are contained in the Memorandum on Smoke Control Areas revised by the Department of the Environment Circular 51/65. In Circular 32/71 the Department set cost limits for local authority guidance in assessing "reasonable costs":—

Smoke Control Area Grants: Cost Limits for Various Appliances (Circular 135/73)

	£
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar)	11
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar) with boiler	24*
Underfloor draught fire and fan assisted open fire	25
Underfloor draught fire and fan assisted open fire with boiler	33*
Solid fuel room heater	45
Solid fuel room heater with boiler	56*
Gas room heater	32
Electric thermal storage heater	39
Direct acting electric space heater	22
Oil room heater	32
Solid fuel cooker with boiler	132
Gas or electric cooker	60
Independent solid fuel boiler, **including installation**	55
Gas water heater (e.g. gas circulator and back boiler unit), **including installation**	44
Electric immersion water heater, **including installation**	27
Wash boiler, gas and electric	22
Gas poker, including flex and tap	5
Bottled gas igniter, if gas container is hired	4
Bottled gas igniter, including purchase of gas container	10
Electric kindler	10

*£3 may be added where
(i) it would be impossible or inadvisable to connect the existing boiler to the new space-heating appliance, and
(ii) either
  (*a*) the existing boiler is itself bower-barffed or made of stainless steel, copper, aluminium, bronze or other superior material, or
  (*b*) one of the above types is necessary to comply with local water bye-laws.

It is for the local authority to decide, within the appropriate level, what costs are reasonable in each case. In general the Department of the Environment will not accept as eligible for grant any expenditure which exceeds the stated limit.

G Statutory Procedure in the Event of an Offence for Excessive Smoke Emission

Section 30 of the 1956 Act requires the local authority authorised officer (usually the Public Health Inspector) to notify "as soon as may be" the occupier of the premises of the offence and to confirm his notification in writing within 48 hours of becoming aware of the offence.

This requirement applies to a contravention of Section one and eleven of the 1956 Act, i.e. Dark/Black smoke emission, and smoke emission in a smoke control area, and to Section one of the 1968 Act, i.e. dark smoke emission from industrial or trade burning. In any subsequent proceedings it is a defence to prove that the notification was not made "as soon as may be" or that the notification was not confirmed within two days following the date of offence.

H Statutory Smoke Nuisance:

Part III of the Public Health Act 1936 defines certain statutory nuisances, and prescribes the legal procedure for enforcing their abatement.

Section 16 of the Clean Air Act 1956 extends the provisions of Part III of the Public Health Act 1936, to include smoke nuisance, but a smoke nuisance cannot include:—

(i) smoke emitted from a chimney of a private dwelling, or
(ii) dark smoke from a chimney of a building or boiler or other plant (controlled by Section 1 of the 1956 Act), or
(iii) dark smoke caused by industrial or trade burning (controlled by Section 1 of the 1968 Act).

Where a smoke nuisance exists, the local authority may pursue the lengthy and cumbersome nuisance procedure, but if they are satisfied that the nuisance has occurred, has temporarily ceased, but is likely to recur, they may, without serving an Abatement Notice, cause a complaint to be made to the Magistrate's Court for the making of a Nuisance Order, following which the provisions of Part III of the Public Health Act 1936 for enforcement of the Order will apply.

Summary of the provisions relating to smoke emission

1. New plant must be capable of substantially smokeless operation.
2. The proposed installation of new furnaces must be notified to the local authority.
3. There are permitted periods for dark and black smoke emission from chimneys, and these standards apply throughout England and Wales.
4. The Permitted Periods Regulations apply whether or not premises are subject to a Smoke Control Order, but additionally, if in a Smoke Control Area, the occupier must ensure that smoke emission is prevented, or, where plant or premises are conditionally exempted, he must ensure that smoke emission is minimised.
5. A grant of 7/10ths of reasonable expenditure is available for the adaptation or replacement of domestic coal burning and similar open fires in a Smoke Control Area.
6. Dark smoke emission from bonfires, etc., on industrial or trade premises is, subject to exemptions, prohibited.
7. The authorised officer must notify the occupier of premises as soon as may be of the existence of an offence, and must confirm his notification in writing within 48 hours.
8. Smoke, other than smoke emitted from a dwelling, dark smoke from a chimney or dark smoke from industrial or trade burning, may if it causes a nuisance be regarded as a Statutory Nuisance under the Public Health Acts.

2. THE CONTROL OF CHIMNEY HEIGHTS

At whatever height smoke and flue gases are discharged, gravity will eventually bring the larger particles of grit, dust and soot to the ground. Additionally, because of the natural turbulence of the atmosphere, a proportion of the gases and of the freely suspended fine particles will reach the ground although not affected by gravity. The higher the point of discharge and the greater the total heat content of the discharge gases, the more widespread and diluted will be the fine particles and gases by the time they reach ground level.

The Legal Control of Chimney Heights

The legal control of chimney heights enables the local authority to take into account a number of relevant factors in determining the height of a chimney to avoid down draught or down wash created by the chimney itself, by buildings or topographical features, and to avoid the ground level concentration of the products of combustion from becoming prejudicial to health or a nuisance, or in the case of smaller units to prevent the flue gases from entering nearby buildings in too high a concentration. All chimneys must comply with the structural requirements of the Building Regulations 1972, but the control of the height or position of the terminal is now exercised under the provisions of the Clean Air Act 1968 or the Building Regulations 1972, according to the fuel consumption of the plant served by the chimney. Further control is available in the Public Health Act 1961 when a new building is proposed which will over-reach the chimney of an adjacent building and affect the dispersal of the products of combustion.

A The Clean Air Act 1968—Section 6

This section of the 1968 Act amends and extends the provisions of Section 10 of the Clean Air Act 1956, which it has largely replaced (except to control the height of chimneys serving non-combustion processes).

Whereas by Section 10 of the 1956 Act a local authority could control a chimney height only if building plans indicating a proposal to erect a chimney were submitted for approval, it must now, under the new provisions, consider a chimney height when:—

(i) a new chimney is erected to serve a new or existing furnace,
(ii) a furnace served by an existing chimney is enlarged, i.e. when its combustion space is increased, e.g. by the addition of a new furnace to an existing range of furnaces,
(iii) a furnace served by an existing chimney is removed and replaced by one having a larger combustion space,

but only if the furnace:—

(*a*) burns or is to burn pulverised fuel; or
(*b*) burns or is to burn at a rate of 100 lbs. or more an hour any other solid matter; or
(*c*) burns or is to burn at a rate equivalent to 1¼ million Btu or more per hour any liquid or gaseous matter.

An application for chimney height approval should preferably be on the form prescribed in the Clean Air (Heights of Chimneys) (Prescribed Form) Regulations 1969 (Statutory Instrument 1969 No. 412) but this does not preclude the local authority from considering an application even though not on the prescribed form, if the information provided by the applicant is sufficient.

The local authority must consider an application and give a written decision within 28 days of receiving the application, unless it is agreed in writing between the local authority and the applicant that a longer period may be allowed; the local authority, however, must not approve the proposed chimney height unless they are satisfied that it will be sufficient to prevent, so far as is practicable, the smoke, grit, dust, gases or fumes emitted from the chimney from becoming prejudicial to health or a nuisance, having regard to:—

(i) the purpose of the chimney,
(ii) the position and descriptions of buildings near to it,
(iii) the levels of the neighbouring ground,
(iv) any other matters requiring consideration in the circumstances.

Any approval of the height of a chimney may be granted unconditionally or subject to conditions as to the rate and/or quality of emissions from the chimney.

> "rate of emission" is defined as the quantities of any specified substance which may be emitted in a period specified in the conditions attached to the approval, e.g. lbs./hr. of sulphur dioxide.

Many other miscellaneous emissions may, of necessity, be considered for inclusion in conditions as to the rate of emission, but there will be cases where a limitation on "rate" alone will not sufficiently ensure against excessive pollution by materials other than normal combustion products, and in those cases it might be appropriate to impose conditions as to the "quality" (i.e. concentration) of the emission.

A limitation on the quality of emission would be appropriate if the products of combustion contain gases or acid mists resulting from abnormal reactions or breakdown of materials derived from chlorinated or sulphur bearing compounds, etc., or if products of combustion are mixed with waste gases from non-combustion processes.

There will also be occasions, particularly in relation to metallurgical processes, where the optical density of emissions may be regulated by reference to percentage obscuration or perhaps by reference to the Bacharach scale.

If a local authority fails to give a written decision within 28 days, the approval applied for is deemed to be granted without qualification.

If the local authority decide not to approve the height of a chimney or to attach conditions to their approval, they must give the applicant a written notification of their decision, stating their reasons, and they must additionally specify the lowest height, if any, which they are prepared to approve unconditionally and/or the lowest height they are prepared to approve with any specified conditions. The applicant may, within 28 days, appeal against the decision to the Secretary of State for the Environment, or the Secretary of State for Wales or for Scotland as appropriate.

In the event of an appeal being lodged, the Secretary of State may confirm the decision against which the appeal is made, or may amend the height or conditions as he thinks appropriate. He must also give a written notification of his decision stating his reasons and, where he does not approve a chimney height, specifying what height, with and/or without conditions, he would approve.

It is not necessary to apply for chimney height approval for any exempted boiler or plant, and the Secretary of State has made the Clean Air (Heights of Chimneys) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 411).

These Regulations provide in substance that chimney height approval is not required where a boiler or plant is used:—

(i) as temporary replacement for a boiler or plant which is under inspection or being maintained, repaired, rebuilt, or replaced by another permanent boiler or plant;
(ii) as a temporary source of heat or power for building or engineering construction work;
(iii) as a temporary source of heat or power for investigation or research;
(iv) as an auxiliary plant used to bring other plant to an operating temperature;
(v) as a mobile or transportable source of heat or power for agricultural operations.

Although a boiler or plant, when used wholly for one of the prescribed purposes, is exempt from the provisions requiring the height of the chimney to be approved, it is nevertheless subject to the other relevant provisions of the Clean Air Acts, and to the nuisance provisions of the Public Health Act 1936.

The Practical Determination of the Height of Chimneys Controlled Under the Clean Air Act 1968

Products of combustion emitted from chimneys serving furnaces burning conventional solid, liquid or gaseous fuels may contain:—

(*a*) *Solids*
Smoke, dust, ash, grit, fume.
(*b*) *Gases*
Carbon monoxide, carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen, hydrocarbons, oxygen and nitrogen; and a number of other minor constituents, including a host of trace elements.

By good combustion and the installation of efficient arrestors, the emission of solids, and to a lesser extent some of the gases, can be minimised, but removal of, for instance, sulphur dioxide is impracticable and the gases must therefore be discharged through a chimney of adequate height.

The basic thesis in the use of tall chimneys for waste gas dispersal is that there are no such things as dangerous gases or fumes, only dangerous concentrations.

The function of the chimney is to reduce the resulting ground level concentration of each constituent of the emission so that it is below the threshold which gives rise to a health hazard or a nuisance.

Under ideal conditions, and so far as gases are concerned, the ground level concentrations from a chimney discharge vary directly with the mass rate of emission and inversely with the wind speed and the square of the effective chimney height. Maximum ground level concentrations occur at about 10–15 times effective chimney heights distance.

Until the first edition of the Memorandum on Chimney Heights issued by the Ministry of Housing and Local Government in 1963, local authorities had a number of formulae which they could use for the calculation of a chimney height, particularly those recommended by the Beaver Committee in Appendix VI of its Final Report.

Revised in October 1967, the Memorandum on Chimney Heights still follows the basic principle in the amended edition that the pollution downwind from a chimney should not exceed a predetermined limit and that pollutants from the chimney must be considered in relation to pollution which exists from other sources.

Using either an average sulphur content for coal and oil of 1·6% and 3% respectively, or preferably using the known sulphur content, it is easy to calculate the mass emission of SO_2 (not forgetting that in the case of coal, 10% of the sulphur remains in the ash). In practice, because of the tremendous variation in sulphur content of coal it is usual to take the average of 1·6% for determining chimney heights, but to use the specification maximum for a particular class of oil when that fuel is to be used. It is also usual to base the fuel consumption on the maximum continuous rating of the boiler or other plant. Thus the chimney height is based on the maximum possible SO_2 emission from the plant and gives the industrialist some flexibility in the amount of fuel he might then burn without contravening the Act.

In the Memorandum, after the introduction of a description of the method, are printed a number of charts which allow firstly an uncorrected chimney height to be obtained based on SO_2 emission and the type of locality; and secondly a final height to be obtained by relating the uncorrected height to the height and/or length of the building in which the furnace is installed or the height of adjacent buildings.

An accurate assessment of the type of locality is important in determining the uncorrected chimney height, and the Memorandum gives the following guidance:—

(*a*) An undeveloped area where development is unlikely, where background pollution is low, and where there is no development within half a mile of the new chimney.
(*b*) A partially developed area with scattered houses, low background pollution, and no other comparable industrial emissions within a quarter of a mile of the new chimney.
(*c*) A built-up residential area with only moderate background pollution and without other comparable industrial emissions.
(*d*) An urban area of mixed industrial and residential development, with considerable background pollution and with other comparable industrial emissions within a quarter of a mile of the new chimney.
(*e*) A large city, or an urban area of mixed heavy industrial and dense residential development, with severe background pollution.

Category *c* represents average conditions, whilst categories *a*, *b*, *d* and *e* represent adjustments up or down, according to probable existing background pollution. Thus a chimney will be lower in Area *a* than in Area *c*, and highest in Area *e*.

It is emphasised that the Memorandum provides a relatively simple method of calculating the approximate chimney height commonly desirable in normal circumstances. There will sometimes, however, be occasions involving complex developments, or topographical complications, which are impossible to assess precisely by either experience or mathematics and it will then be necessary to have wind tunnel tests carried out on scale models.

Heights of Chimneys Serving Furnaces Not Burning Sulphur Bearing Fuels

The Memorandum can be utilised for determining stack heights only if the "fuel" contains sulphur in significant proportions, and there are no constituents of the chimney gases that are of more importance in relation to public health or nuisance than sulphur dioxide. Where there is no SO_2 emission, or where other constituents are of more importance, the height of the chimney cannot be assessed by use of the Memorandum on Chimney Heights. During 1970 the Warren Spring Working Group on Chimney Heights was reconstituted to produce a report recommending chimney heights for furnaces to burn natural gas, towns gas, liquid petroleum gas and low sulphur fuel oils. The working group is expected to produce its report during 1973.

B Clean Air Act 1956—Section 10

Although Section 10 of the 1956 Act no longer applies to a chimney serving a furnace, it will still apply to a chimney serving a non-combustion process, providing Building Regulation plans are required to be submitted for local authority approval. If the chimney is insufficient to prevent the emissions from becoming prejudicial to health or a nuisance, the local authority must reject the plans, and an aggrieved applicant may appeal to the Secretary of State for the Environment.

C. The Building Regulations 1972

The earlier notes show that the Clean Air Acts control chimney heights only if the fuel consumption is 100 lbs. or 1·25 million B.t.u. or more per hour.

The Building Regulations 1972 apply to *all* chimneys irrespective of the capacity of the fireplace or furnace, no matter what type of building the unit is installed.

Regulation L2(4)(*a*) requires that the flue outlet of a high rating appliance shall be so situated as to prevent the discharge therefrom into the external air from entering any opening into a building in such a concentration as to be prejudicial to health or a nuisance.

A "high rating appliance" is defined as
- (*a*) a solid fuel burning appliance or oil burning appliance with an output rating exceeding 45 kw.
- (*b*) a gas appliance having an input rating exceeding 45 kw.
- (*c*) an incinerator having a refuse combustion chamber exceeding $0{\cdot}03m^3$ in capacity.

In the case of Class I or Class II appliances the flue terminals must be correctly placed in accordance with Regulations 13 and 21 respectively.

A "Class I appliance" is defined as
- (*a*) a solid fuel appliance or oil burning appliance having an output rating not exceeding 45 kw.
- (*b*) an incinerator having a refuse combustion chamber capacity between $0{\cdot}03m^3$ to $0{\cdot}08m^3$.

A "Class II appliance" is defined as
- (*a*) a gas appliance having an input rating not exceeding 45 kw.
- (*b*) an incinerator having a refuse combustion chamber not exceeding $0{\cdot}03m^3$ in capacity.

D Public Health Act 1961

Section 28 of this Act applies when a new building is erected which will overreach the chimney of an adjoining building.

Providing that the chimney of the lower building is in the party wall between it and the taller building, or is 6 feet or less from the taller building, the local authority may by notice require the person who erects the taller building to raise the height of the chimneys of the adjoining building if it is reasonably practicable to do so, so that the chimneys are the same height as the taller building or its chimneys, whichever is the higher.

The notice will also require the owner or occupier of the adjoining building to allow the work to be done, but he may elect to do the work himself and charge the reasonable cost of so doing to the person on whom the notice was served.

In the event of non-compliance with the notice, the local authority may do the work in default.

Chimney Design

It is essential to emphasise that whilst the physical and effective heights of any chimney are of importance in ensuring the eventual dispersion of the waste gases etc., other features of the chimney (e.g. its shape, quality of thermal insulation, and cross sectional area at the outlet) must be carefully designed if stack inversion, acid condensate, smut emission, and downwash are to be avoided.

Summary of the Provisions Relating to Chimney Heights

The occupier of premises must seek approval of a chimney height when:—

1. (i) a new chimney is to be erected,
   (ii) an existing furnace installation is to be enlarged,
   (iii) a furnace is to be replaced by one of larger combustion capacity,
   but only if the new or enlarged plant is to burn pulverised fuel; other solid matter at 100 lbs. or more per hour; or liquid or gaseous matter at 1·25 million Btu or more per hour.
2. The local authority must give a written decision within 28 days, and may prescribe conditions.
3. The applicant can appeal to the Secretary of State for the Environment within 28 days of receiving the local authority decision, if aggrieved by the decision or conditions.
4. Chimney height approval is not required for certain exempted plant—mainly of temporary or experimental nature.
5. All chimneys must comply with the relevant provisions of the Building Regulations 1972 as to the position of the terminal.
6. In general the Ministry Memorandum on Chimney Heights is used, unless there are parameters more important than SO_2 emission which must be considered.
7. In some circumstances, the developer of a tall building may be required to raise the height of the chimneys of an adjoining building.

3. THE CONTROL OF GRIT, DUST AND FUME EMISSIONS

Although "grit" is defined in the Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 as "particles exceeding 76 microns in diameter", and "fume" is defined in the 1968 Act as "solid particulate matter smaller than dust", there is no definition of "dust".

It is, however, generally accepted that "dust is particulate matter smaller than 76 microns with a lower limit of one micron", and "fume" is sub-micronic in size.

Under the provisions of the 1956 Act the underlying principle in relation to stack solids was that any practicable means should be used for minimising grit and dust emissions. The various definitions recognised that technical problems would prevent the

complete elimination of emissions and that the measures required would vary according to circumstances. The requirement for grit arrestors to be installed in connection with new plant related only to those burning pulverised fuel, or other solid matter at the rate of one ton or more per hour.

The provisions of the 1968 Act take these first principles a stage further and also allow the various provisions to be related to fume emission as and when the Secretary of State feels the time to be appropriate.

The new provisions considerably strengthen and extend the local authority powers in relation to this problem, and since they are of fundamental importance they are set down under a series of sub-headings.

A Power of the Secretary of State to Prescribe Limits of Emission

Section two of the 1968 Act gives the Secretary of State power to prescribe limits on the rates of emission of grit and dust from the chimneys of furnaces, and to prescribe different limits for different cases and according to different circumstances.

(i) Working Party on Grit and Dust Emissions

During 1964 the then Minister of Housing and Local Government was considering the possibility of making Regulations to enable local authorities to require industrialists to measure grit and dust emissions. He decided that before doing so it would be advisable for local authority staff to receive guidance as to the available methods of measuring grit and dust, and the levels of emission, from various types of plant, which would be acceptable. Accordingly a Working Party on Grit and Dust Emissions was convened with the following terms of reference:—

> "To consider ways and means of measuring grit and dust emissions and to advise on the levels of emission admissible in relation to furnaces burning fuel equivalent to 100 lbs. to 50,000 lbs. of coal per hour."

The Report, published in 1967 proposed limits on the acceptable levels of emission from coal fired and oil fired boilers, and from furnaces where the stock being heated does not contribute to the emissions.

The working party considered that there was insufficient reliable data of emissions from furnaces where the stock contributed to emissions, or from incinerators, and recommended that there should be initiated a systematic study to obtain emission data from a representative sample of these classes of furnaces and, at the same time, to obtain some reliable information on the current technology of emission prevention. This study has recently been undertaken by N.I.F.E.S.

Those recommendations included in the Report were stated in lbs./hour of grit and dust emitted during a period of normal operation, including peak loads. In the case of coal fired plant the acceptable emissions ranged from 1% of the fuel, fired at a low rate of burning (100 lbs./hour) to 0·5% of the fuel fired at the top rate of burning (50,000 lbs./hour); and in the case of oil fired plant the acceptable emissions reduced from 0·4% of the fuel fired at a low rate of burning to 0·2% of the fuel fired at the top rate of burning. In the case of coal fired plant the working party recommended that the percentage grit in the sample from plant burning up to one ton per hour should not exceed 33%, and from plant burning over one ton per hour should not exceed 20%.

The Report of the Working Party was later endorsed by the then Ministry of Housing and Local Government in its publication "Grit and Dust—The Measurement of Emissions from Boiler and Furnace Chimneys—Standard Levels of Emission."

(ii) The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (Statutory Instrument 1971 No. 162)

The Regulations were made on the 1st February 1971, and came into operation on the 1st November 1971. They express in parliamentary and legal terminology the recommendations of the Working Party on Grit and Dust Emissions, but for a period until 1st January 1978 the Regulations will apply only to plant for which an agreement in respect of its purchase or installation was entered into after the date of operation i.e. there is a seven year exemption for existing installations.

The Regulations apply to:—

(*a*) boilers;
(*b*) indirect heating appliances (being heating appliances in which the combustion gases are not in contact with the material being heated);
(*c*) furnaces in which the combustion gases are in contact with the material being heated but that material does not in itself contribute to the grit and dust in the combustion gases.

The Regulations do not apply to incinerators burning refuse or waste matter (solid or liquid) whether or not the resulting heat is used for any purpose.

Schedules 1 and 2 of the Regulations tabulate the quantities of grit and dust which may be emitted, and where the rating of the boiler or furnace is intermediate between the tabulated values, the maximum permitted emission is obtained by interpolation:—

Schedule 1—Furnaces Rated by Heat Output

This schedule applies to boilers and also indirect heating appliances in which the material being heated is a gas or a liquid (e.g. an air heater) but where an indirect heating appliance falls also within the provisions of schedule 2, it shall be treated as schedule 1 furnace.

The amount of grit and dust which may be emitted is as follows:—

Max. Continuous Rating in lbs. of steam/hr. (from and at 100°C (212°F) *or in thousands of Btu/hr.*	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning solid matter	*Furnaces burning liquid matter*
,825	1·10	0·25
1,000	1·33	0·28
2,000	2·67	0·56
3,000	4·00	0·84
4,000	5·33	1·12
5,000	6·67	1·4
7,500	8·50	2·1
10,000	10·00	2·8
15,000	13·33	4·2
20,000	16·67	5·6
25,000	20·0	7·0
30,000	23·4	8·4
40,000	30	11·2
50,000	37	12·5
100,000	66	18
150,000	94	24
200,000	122	29
250,000	149	36
300,000	172	41
350,000	195	45
400,000	217	50
450,000	239	54·5
475,000	250	57

Schedule 2—Furnaces Rated by Heat Input

This schedule applies to indirect heating appliances and to furnaces in which the combustion gases are in contact with the material being heated, but that material does not in itself contribute to the grit and dust in the combustion gases.

The amount of grit and dust which may be emitted is as follows:—

Heat input in millions of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning Solid Matter	*Furnaces burning Liquid Matter*
1·25	1·1	0·28
2·5	2·1	0·55
5·0	4·3	1·1
7·5	6·8	1·7
10	7·6	2·2
15	9·7	3·3
20	11·9	4·4
25	14·1	5·5
30	16·3	6·6
35	18·4	7·7
40	20·6	8·8
45	22·8	9·8
50	25	10·9
100	45	16
200	90	26
300	132	35
400	175	44
500	218	54
575	250	57

The Regulations limit the grit in the sample of grit and dust to the following proportions:—

	Grit not to exceed 33%	*Grit not to exceed* 20%
Schedule One Furnaces	Where maximum continuous rating does not exceed 16,800 lbs./hr. of steam or 16,800,000 Btu/hr.	In any other case.
Schedule Two Furnaces	Where designed heat input of the furnace does not exceed 25,000,000 Btu/hr.	In any other case.

Grit is defined as those particles exceeding 76 microns in diameter (i.e. will remain on a BS.200 mesh sieve).

Multiflue chimneys are defined and for the purpose of the regulations each flue is to be taken as a separate chimney for the purpose of calculating acceptable emissions.

Where a chimney serves a furnace to which the regulations apply and also a furnace to which the regulations do not apply, the emissions from the latter shall be disregarded.

The prescribed limits apply to any period of standard operation of the furnace, including periods during which it is at or close to the loading to which it is subject for the greater part of its working time, or at any higher loading to which it is regularly subject for a limited time (whether or not this exceeds the furnace M.C.R. or designed heat input).

N.B. (1) Until the Regulations are made to apply to existing furnaces, or additional Regulations are made for furnaces where the material being heated contributes to the grit and dust emission, the occupier of the premises must use "any practicable means" for minimising the grit and dust emission.

(2) If the grit and dust emission from a chimney serving a furnace to which the Regulations apply, exceeds the permitted limit, there is a defence that the "best practicable means" had been used to prevent the emission.

The definition of "practicable" in the 1956 Act (it applies also to the 1968 Act) is of importance:—

> "Practicable" means reasonably practicable having regard, amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge, and "*practicable means*" *includes the provision and maintenance of plant and the proper use thereof.*

During 1972, the Secretary of State for the Environment appointed a new Working Party on Grit and Dust Emission with the following terms of reference:—

> "To advise on the levels of emission admissible under Section 2 of the Clean Air Act 1968 in relation to incinerators, and to furnaces where the material being heated contributes to the emission."

The Working Party has appointed three "panels" to study emissions from
(i) Incinerators
(ii) Cupolas
(iii) Miscellaneous Furnaces.

It is anticipated that the Working Party will report to the Department of the Environment on the deliberations of the panels during 1974.

B Arrestment Plant for New Furnaces

Section 6 of the Clean Air Act 1956 required that certain larger new furnaces, the installation of which was commenced (or was subject to an agreement signed) between July 1956 and October 1969, should be equipped with approved grit and dust arrestment plant and that the arrestors must be properly maintained and used. These provisions still apply to furnaces which are used:—
(i) to burn pulverised fuel; or
(ii) to burn, at a rate of one ton an hour or more solid fuel in any other form or solid waste,

providing that the plant was installed or an agreement was signed between the above-mentioned dates.

Section 3 of the 1968 Act states that if new plant is to be installed after the 1st October 1969 (or is subject to an agreement signed after that date) and it is to be used
(*a*) to burn pulverised fuel; or
(*b*) to burn, at a rate of 100 pounds or more an hour, any other solid matter; or
(*c*) to burn, at a rate equivalent to 1¼ million or more British thermal units an hour, any liquid or gaseous matter,

it must, unless exemption has been provided, be equipped with grit and dust arrestment plant. In the event of a local authority refusing approval there is a right of appeal to the Secretary of State within 28 days of receiving the local authority's written decision.

Two types of exemption are possible by virtue of Section 4 of the 1968 Act:—
(i) The Secretary of State has power to provide in Regulations that furnaces of any particular class, whilst used for a prescribed purpose, should be exempted. He has now made the Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 1262) as follows:—

Class of Furnace	*Purpose*
1. Mobile or transportable furnaces.	(*a*) Providing a temporary source of heat or power during any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961); (*b*) providing a temporary source of heat or power for investigation or research; (*c*) providing heat or power for the purpose of agriculture (within the meaning of section 109(3) of the Agriculture Act 1947).
2. Furnaces, other than furnaces designed to burn solid matter at a rate of one ton an hour or more, which fall within any of the following descriptions and in which the matter being heated does not contribute to the emission of grit and dust:— (*a*) Furnaces burning liquid matter, gas, or liquid matter and gas; (*b*) hand-fired sectional furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*c*) magazine type gravity-fed furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*d*) furnaces fitted with an underfeed stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of the plan area of the combustion chamber; (*e*) furnaces fitted with a chain grate stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*f*) furnaces fitted with a coking stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of area covered by the fire bars excluding the solid coking plate.	Any purpose except the incineration of refuse

(ii) The local authority may, on application, exempt a specific furnace installation providing that they are satisfied that the emissions will not be prejudicial to health or a nuisance. The local authority must give a written decision within eight weeks, and an aggrieved applicant may appeal within a further 28 days, to the Secretary of State.

An offence occurs if a furnace is exempt and is then used for a purpose other than one prescribed in the exemption.

When considering an application for approval of a proposed arrestor plant (or an application for exemption from the need to install an arrestor plant) the local authority will have regard to the probable grit and dust burden in the flue gases, and to the known efficiency of the proposed arrestor plant in order that they might compare the probable emission with any standard which might at the time be in force or which is under consideration. Industrialists and consultants would, in turn, be wise to remember that the Working Party on Grit and Dust Emissions proposed that their recommended standard levels of emission should be reviewed after three years in operation and that arrestor plant, unless very well maintained at all times, rarely operates at design efficiency after a few years in use.

C The Measurement of Grit and Dust Emissions

The legal provisions concerning the measurement of grit and dust emissions are to be found in Section 7 of the 1956 Act as amended by Section 5 of the 1968 Act. Regulations have been made which prescribe the procedure to be followed by a local authority which wishes grit and dust measurement to be made and by the industrialist on whom a notice has been served.

If a furnace (or range of furnaces served by one chimney) is used to burn:—

(i) pulverised fuel, or
(ii) any other solid matter at a rate of 100 lbs. or more per hour, or
(iii) any liquid or gaseous matter, at a rate equivalent to 1¼ million or more Btu/hr.
the local authority may serve a notice on the owner of the plant or occupier of the building, requiring grit and dust emissions to be measured.

If the plant burns:—

(i) less than one ton/hour of solid matter other than pulverised fuel, or
(ii) less than 28 million Btu/hour of liquid or gaseous matter.

the industrialist may serve a "counter notice" on the local authority, requiring the authority to carry out the measurements at its own expense, and the local authority is obliged to do so "from time to time" unless the counter notice is, in writing, withdrawn.

The Clean Air (Measurement of Grit and Dust) Regulations 1971 (Statutory Instrument 1971 No. 161), prescribe the administrative process to invoke the above provisions (a similar set of Regulations apply to Scotland):

(*a*) A local authority must give at least six weeks' notice in writing to an industrialist requiring:—

(i) adaptations to be made to the chimney or flues, and
(ii) the provision of the necessary equipment,

to enable measurements to be made in accordance with BS.3405:1961 "Simplified Methods for Measurement of Grit and Dust Emission from Chimneys". The British Standard describes five different types of equipment which can be used, and it is necessary to ensure that the type and position of sampling points is correct in relation to the type of equipment which will be used. The British Standard is currently under review.

(*b*) When the sampling points have been installed and the equipment provided (or it is known that the firm are engaging a consultant who possesses the equipment), the local authority must give at least 28 days' notice in writing, requiring the tests to be carried out in accordance with the methods details in pp.13–26 of the B.C.U.R.A. publication "Measurements of Solids in Flue Gases".

(*c*) Before making the measurement, the industrialist must give the local authority at least 48 hours' notice in writing, of the date and time of the commencement of the tests.

(*d*) The 1968 Act requires the industrialist to permit the local authority to be represented during the tests.

(*e*) The result of the test must be sent to the local authority within 14 days from the making of the measurements, and the reports shall include:—

(i) the date(s) of the test(s);
(ii) the number of furnaces discharging into the chimney on that date;
(iii) the results of the measurements expressed in lbs./hour of grit and dust emitted, and in the case of solid fuel fired plant, the percentage of grit in the solids.

A notice may require the making of measurements from time to time or at stated intervals, but not at intervals of less than 3 months unless in the opinion of the local authority, the true level of emission cannot be determined without further measurement being made.

If an industrialist serves a "counter-notice" on the local authority, he need comply only with the (*a*)(i) above, i.e. make adaptations to the chimney to enable the measurement to be made, including the provision of scaffolding where necessary, and the provision of facilities such as electrical connections to enable the sampling equipment to be used. The local authority must provide the sampling equipment and conduct the test entirely at its own expense.

In various circulars and publications, the Ministry of Housing and Local Government, and the Working Party have emphasised that the measurement of grit and dust emissions is both time consuming and costly. It is unlikely, therefore, that local authorities will authorise the indiscriminate service of hundreds of notices on industrialists, but will concentrate in the first instance on those units which are thought to be giving rise to complaint of nuisance, or which they suspect are emitting solids grossly in excess of the proposed limits. In any event the majority of local authorities have still to arrange for their staff to be trained in the use of the sampling equipment.

D Fume Emission

Fumes are defined in the 1968 Act as "any airborne solid matter smaller than dust", and by this definition acid mist or liquid droplets are thereby excluded.

By virtue of the 1968 amendment to the definition of chimney in the 1956 Act, this now "includes structures and openings of any kind from or through which smoke, grit, dust or fumes may be emitted, and in particular includes flues".

There are, at the moment, no legal provisions which require the reduction or elimination of fume emissions, other than those specific fumes which are controlled by the Alkali Inspectors under the provision of the Alkali &c. Works Regulation Act 1906, as amended and extended by the Clean Air Acts 1956 and 1968, and by the Alkali Works Order 1966.

An important provision in the 1968 Act for possible future consideration is the power in Section 7 of the Secretary of State to apply to "fumes", certain provisions of the 1956 and the 1968 Acts, i.e. by Regulations the Secretary of State may apply the following provisions to fumes, as they apply to grit, dust or smoke:—

(*a*) **Clean Air Act 1956—Section 3**
Requirement that new furnaces shall be so far as practicable smokeless "*and fumeless*".

(*b*) **Clean Air Act 1968—Section 2**
Emissions of grit, dust "*and fumes*" from furnaces (standard levels of emission).
Clean Air Act 1968—Section 3
Requirements to fit arrestment plant (*including fume arrestors*) to new furnaces.

Additionally, the Secretary of State has power to extend certain exemption provisions so that they relate to fume emissions or avoid the need to install fume arrestment plant.

4. MISCELLANEOUS PROVISIONS OF THE CLEAN AIR ACTS 1956 AND 1968

A. The Clean Air Act 1956 Section 4—Smoke Density Meters

This Section enables the Secretary of State to make Regulations requiring the installation, maintenance and use of smoke density meters and/or recorders obligatory.

No regulations have yet been made and it is thought that this is because, although smoke density meters can be fairly reliable, they are easily subjected to abuse and the results obtained can be varied almost at will by altering the calibration or failing to clean the viewing glasses, etc., which protect the light source and receiver.

Section 8—Information About Furnaces and Fuel Consumed

The local authority is empowered, by this section, to require an industrialist to supply information within 14 days as to the size of furnaces and fuel consumption but this information, in the vast majority of cases is provided willingly and voluntarily.

Section 18—Colliery Spoilbanks (including Waste Quarry-Shale)

Where a spoilbank is emitting smoke and fumes, or is likely to emit smoke and fumes, the following provisions apply:—

(*a*) **A spoilbank in use as at 5th July 1956, or commenced since that date**

The owner of the mine or quarry is required to employ all practicable means for preventing spontaneous combustion and for preventing emission of smoke and fumes.

(*b*) **A spoilbank the use of which had ceased by 5th July 1956**

If the spoilbank was no longer in use and its control had passed from the owner of the mine or quarry on or before the 5th July, 1956, the problem must be dealt with as a statutory nuisance under the provisions of Part III of the Public Health Act 1936 as amended.

Section 19—Railway Engines

Railway engines are subject to the dark smoke provisions of Section one of the 1956 Act, but are not subject to grit and dust emission provisions, nor to a Smoke Control Order.

Section 20—Vessels

Emission of smoke from vessels has been considered on a previous page.

Section 21—Exemption for Purposes of Investigation and Research

This section gives the local authority power to exempt a particular chimney, boiler or furnace, etc., from varying provisions of the Act when it is expedient to do so, to enable investigations or research relevant to air pollution to be carried out without rendering the applicant liable to proceedings.

If the local authority refuse exemption, the applicant has a right of appeal to the Secretary of State for the Environment.

Section 22—Crown Premises

In the event of excessive emissions of smoke, grit and dust from Crown premises, the local authority should notify the Minister responsible for the premises and he shall take appropriate action to prevent or minimise the emission.

Section 23—Clean Air Council

By means of this section the Secretary of State has established the Clean Air Council with one of his Junior Ministers as Chairman to review progress and obtain advice on air pollution matters. There is also a Clean Air Council for Scotland (Statutory Instrument 1957 No. 766).

Sections 25-29

These sections are mainly administrative and relate to research and publicity, improper disclosure of information by an officer, penalties for offences under the Act (Some of which have been increased by the Criminal Justice Act 1967), authorisation of works, and enforcement of the Act.

B. The Clean Air Act 1968

The only important provisions of this Act not previously mentioned are contained in section 11 and relate to registered processes under the Alkali Act. The section substantially repeals section 17 of the 1956 Act, and in particular removes the power of the local authority to apply to the Secretary of State for authority to institute proceedings in the event of excessive smoke, grit, dust, etc., from registered processes. It also brings within the control of the Alkali Acts "work subject or potentially subject to the Alkali Act".

Building Regulations—Prevention of Smoke Emission

The Building Regulations 1972, include a section, M2, relating to the prevention of emission of smoke. The full text of the section is:—

> "M2. In any building (other than a building erected under former control) there shall not be installed for the purposes of heating or cooking in that or any other building any appliance which discharges the products of combustion into the atmosphere, unless that appliance is designed to burn as fuel either gas, coke, or anthracite. Provided that nothing in this regulation shall prohibit the installation of:—
>
> (i) a furnace which complies with Section 3 of the Clean Air Act 1956; or
>
> (ii) an appliance of a class exempted conditionally or unconditionally from the provisions of Section 11 of the Clean Air Act 1956 (which relates to smoke control areas) by any order for the time being in force under subsection (4) of that section; or
>
> (iii) a solid fuel appliance with a bottom grate unsuitable for burning coke or anthracite but designed so as to be capable of use with an alternative bottom grate which is suitable for burning such fuel.

Protection of the Environment Bill

At the time of going to press it is known that the Government intend to introduce into Parliament a Bill which will give local authorities greater powers and responsibilities for the disposal of wastes, excessive noise and the control of air pollution.

Those sections about air pollution will modify and extend some of the provisions of the Clean Air Acts 1956 and 1968 explained in the previous pages; and it is expected that the maximum penalties for offences under Clean Air legislation will be substantially increased.

Latest information indicates that the Bill will be introduced into Parliament during Autumn 1973 and will probably receive the Royal Assent during the period May to July, 1974.

Readers are recommended to watch for announcements in the Spring and Summer editions of "Clean Air".

5. ROAD TRAFFIC POLLUTION LAW

Reflecting a worldwide trend, over the last few years controls over emissions of gaseous pollutants from petrol-driven vehicles and the use of lead as an additive in petrol have been added to those which previously existed in the UK over diesel exhaust emissions. All these controls except those over the lead content of petrol, which are not yet included in Regulations, are implemented by the Motor Vehicles (Construction and Use) Regulations 1973.

Diesel Engined Vehicles

A number of Regulations are relevant to diesel exhaust smoke. At the manufacturing stage, all vehicles must be so constructed as to emit no avoidable smoke or visible vapour, and other "construction" Regulations apply particularly to diesel engined vehicles. Each new diesel engine for use in a road vehicle must be of a type which has been certified to a British Standard (B.S. A.U.141a) which lays down maximum permissible smoke opacity values for exhaust gases produced over a wide range of engine conditions. Also, excess fuel devices ("chokes") on diesel engines must be so fitted that they cannot be used while vehicles are in motion, if their use could increase the engine's smoke output. Since 1968 the Regulations have required most commercial vehicles to be fitted by their manufacturers with a plate showing particulars of weights and other matters, and the figures on the plate must show that a minimum power/weight ratio is being maintained. In use, no vehicle may emit smoke, vapour, dust, grit or other substances so as to endanger other road users, and engines must not be altered or adapted in a way which increases their smoke output.

Petrol Engined Vehicles

Except for small three-wheeled cars and some exempted models, all petrol engined cars and light commercial vehicles first used on or after 10 November 1973, and manufactured on or after 20 September 1973, must comply with the limits laid down for emissions of hydrocarbons and carbon monoxide in Regulation No. 15 of the United Nations' Economic Commission for Europe.

The actual tests prescribed by ECE Regulation 15 require that the car shall be tested on a chassis dynamometer by a cycle of conditions representing driving in a congested urban area after a cold start. The maximum permissible mass of CO and HCs are set out in a table relating them to the weight of the vehicle concerned.

A second test will be the measurement of the percentage of carbon monoxide at idling speed with a hot engine. The volume of CO content of the exhaust gases must not exceed 4·5%.

Compliance with this Regulation must be attested by an approval mark, legibly and indelibly affixed to the vehicle. Reductions of up to 30% in carbon monoxide and up to 35% in hydrocarbons, compared to an uncontrolled vehicle, result.

In 1972 the Secretary of State for the Environment announced a programme of phased reductions in the permissible lead content of petrol. From a level of ·84 grammes per litre in 1972, the maximum permitted content will be reduced to ·45 grammes per litre by the end of 1975. The oil industry is complying with these standards voluntarily at present, but has agreed that they should become compulsory in due course.

Policy for Anti-Pollution Legislation on Motor Vehicles

Up to now, research has not shown that current levels of emission from motor vehicles offer any threat to health, although pollutants such as lead and carbon monoxide are undesirable since they are toxic in high concentrations, and their effects must be closely monitored. Current legislation will prevent total emissions from motor vehicles from rising significantly above present levels as vehicle population and total fuel usage increase: meanwhile, research into emissions continues and further measures will be taken if the need for them is established. Similar anti-pollution measures are embodied in EEC Council Directives, and are being introduced throughout the Community. In future, it is expected that this standardisation of controls in the EEC will be a major legislative tool for the advancement of environmental objectives on a European scale.

6. THE ALKALI, ETC., WORKS REGULATION ACT

The Alkali, etc., Works Regulation Act, 1906, consolidates and extends previous similar Acts, the first of which was passed in 1863.

The Act includes a schedule of chemical processes and a list of noxious or offensive gases. Since 1906, this schedule and list have been extended by Statutory Orders made under the Public Health (Smoke Abatement) Act, 1926, and the Alkali, etc., Works Regulation (Scotland) Act, 1951. Such orders were made in 1928, 1935, 1939, 1950, 1958, 1961, 1963, 1966 and 1971.

The essence of the Act lies in the requirements that (1) scheduled processes must be registered annually; (2) as a prior condition in the case of a first registration the scheduled process must be provided to the satisfaction of the Chief Inspector with the "best practicable means" for preventing the escape of noxious or offensive gases to the atmosphere and for rendering such gases harmless and inoffensive; (3) the "best practicable means" must thereafter be maintained in good and efficient working order and must be operated continuously; (4) in the case of certain processes, upper limits are specified for the concentration of total acidity in effluent gases which may be discharged to the atmosphere.

Provision is made for the setting up and maintenance of an inspectorate to administer the Act, and regulations are included relating to the registration and inspection of works, general procedure, penalties, etc. The Chief Inspectors are required to make an Annual Report to be laid before Parliament, relating to the work of the inspectorate.

Under the Clean Air Act, 1956, later replaced by the Clean Air Act, 1968, the provisions of the Alkali Act are extended to apply to smoke, dust and grit from premises controlled under the Act as they already do to noxious or offensive gases. Thus from 31 December 1956 virtually all forms of air pollution from processes registered under the Alkali Act are subject to control under that Act by the Alkali Inspectorate. Any other parts of a work are the responsibility of the local authority.

The Alkali, etc., Works Orders

The first four Orders dealt mainly with processes in the heavy chemical and related industries where noxious or offensive gases are the potential offenders. In an Order which came into operation on 1 June 1958 the Minister of Housing and Local Government further extended the Alkali Act by adding to the list of scheduled processes a number which are responsible principally for emissions of smoke, grit and dust. Among these processes are a number for the production of iron and steel, iron or steel melting processes, and some copper and aluminium processes. Gas and coke works, electricity works, coal fired producer gas plant and lime kilns and certain ceramic kilns fired by coal or oil were also added to the list together with sulphate reduction and caustic soda plant and certain types of chemical incinerators. The Order also made the appropriate additions to the list of noxious or offensive gases.

The 1961 Order deals with emissions from the processing of uranium, beryllium, selenium and their compounds. The 1963 Order is much more comprehensive and was prepared largely to take into account the major changes which have taken place in recent years in the heavy chemical and allied industries. It also covers the burning of scrap cable to remove the insulation. This is necessary because of the increasing amount of cable covered with polyvinyl-chloride, which, on burning, gives rise to hydrochloric acid, chlorides and possibly phosgene. The Order begins the policy of descheduling certain of the 1958 Order smoke processes.

The 1966 Order is important, for in addition to making a few minor alterations to the lists of scheduled works and noxious or offensive gases, it revokes all the earlier seven Orders and consolidates them in the 1966 Order. The major effect of the 1971 Order was to schedule Mineral Works, dealing mainly with the crushing, grading and drying of roadstone giving rise to grit and dust problems. Some iron and steel and aluminium processes were descheduled. Thus, all the Alkali Acts and Orders since 1863 are consolidated in the 1906 Act and the 1966 and 1971 Orders.

LIST OF REGISTRABLE WORKS

Under the Alkali &c. Works Regulation Act 1906, as extended by the Alkali &c. Works Orders 1966 and 1971, the works appearing in the following list must be registered annually.

All certificates expire on 1st April, whatever the date of issue.

A certificate of registration becomes invalid if it is not kept up to date when changes occur in the ownership of the works or the other registered particulars. Any such change must be notified to the Ministry and the certificate forwarded for alteration. This will be done free of charge.

It is an offence, carrying a penalty of up to £100, to operate any of these works without a current and correct certificate of registration.

Non-scheduled Works

1. Alkali Works

Works for:

(*a*) The manufacture of sulphate of soda or sulphate of potash, or

(*b*) The treatment of copper ores by common salt or other chlorides whereby any sulphate is formed,

in which muriatic acid gas is evolved.

2. Cement Works

Works in which aluminous deposits are treated for the purpose of making cement.

3. Smelting Works

Works in which sulphide ores, including regulus, are calcined or smelted.

Scheduled Works

These are the works mentioned in the first Schedule to the Act, as extended by the Alkali &c. Works Order 1966, as follows:

1. Sulphuric Acid Works

Works in which the manufacture of sulphuric acid is carried on by the lead chamber process, namely, the process by which sulphurous acid is converted into sulphuric acid by the agency of oxides of nitrogen and by the use of a lead chamber or by any other process involving the use of oxides of nitrogen.

2. Sulphuric Acid [Class II] Works

Works in which the manufacture of sulphuric acid is carried on by any process other than the lead chamber process, and works for the concentration or distillation of sulphuric acid.

3. Chemical Manure Works

Works in which the manufacture of chemical manure is carried on, and works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid and works for the granulating of chemical manures involving the evolution of any noxious or offensive gas.

4. Gas Liquor Works

Works [not being sulphate of ammonia works or muriate of ammonia works] in which sulphuretted hydrogen or any other noxious or offensive gas is evolved by the use of ammoniacal liquor in any manufacturing process, and works in which any such liquor is desulphurized by the application of heat in any process connected with the purification of gas.

5. Nitric Acid Works

Works in which the manufacture of nitric acid is carried on and works in which nitric acid is recovered from oxides of nitrogen and works where in the manufacture of any product any acid-forming oxide of nitrogen is evolved.

6. Sulphate of Ammonia Works, and Muriate of Ammonia Works

Works in which the manufacture of sulphate of ammonia or of muriate of ammonia is carried on.

7. Chlorine Works

Works in which chlorine is made or used in any manufacturing process.

8. Muriatic Acid Works

(*a*) Muriatic acid works, or works [not being alkali works as defined in the Act] where muriatic acid gas is evolved either during the preparation of liquid muriatic acid or for use in any manufacturing process or as the result of the use of chlorides in a chemical process;

(*b*) Tinplate flux works, works in which any residue or flux from tinplate works is calcined for the utilization of such residue or flux, and in which muriatic acid gas is evolved; and

(*c*) Salt works, works [not being works in which salt is produced by refining rock salt, otherwise than by the dissolution of rock salt at the place of deposit] in which extraction of salt from brine is carried on, and in which muriatic acid gas is evolved.

9. Sulphide Works

Works in which sulphuretted hydrogen is evolved by the decomposition of metallic sulphides, or in which sulphuretted hydrogen is used in the production of such sulphides, or any works in which sulphuretted hydrogen is evolved as part of a chemical process.

10. Alkali Waste Works

Works in which alkali waste or the drainage therefrom is subjected to any chemical process for the recovery of sulphur or for the utilization of any constituent of such waste or drainage.

11. Venetian Red Works

Works for the manufacture of Venetian red, crocus or polishing powder, by heating sulphate or some other salt of iron.

12. Lead Deposit Works

Works in which the sulphate of lead deposit from sulphuric acid chambers is dried or smelted.

13. Arsenic Works

Works for the preparation of arsenious acid, or where nitric acid or a nitrate is used in the manufacture of arsenic acid or an arseniate and works in which any volatile compound of arsenic is evolved in any manufacturing process and works in which arsenic is made.

14. Nitrate and Chloride of Iron Works

Works in which nitric acid or a nitrate is used in the manufacture of nitrate or chloride of iron.

15. Bisulphide of Carbon Works

Works for the manufacture, use or recovery of bisulphide of carbon.

16. Sulphocyanide Works

Works in which the manufacture of any sulphocyanide is carried on by the reaction of bisulphide of carbon upon ammonia or any of its compounds.

17. Picric Acid Works

Works in which nitric acid or a nitrate is used in the manufacture of picric acid.

18. Paraffin Oil Works

Works in which crude shale oil is refined.

19. Bisulphite Works

Works in which sulphurous acid is used in the manufacture of acid sulphites of the alkalis or alkaline earths and works for the manufacture of liquid sulphur dioxide or of sulphurous acid or of any sulphite and works [not being smelting works as defined in section 8, sub-section [1] of the Act of 1906 or other works defined elsewhere in this schedule] in which oxides of sulphur are evolved in any chemical manufacturing process.

20. Tar Works

Works where gas tar or coal tar is distilled or is heated in any manufacturing process and works in which creosote or any other product of the distillation of gas tar or coal tar is distilled or is heated in any manufacturing operation involving the evolution of any noxious or offensive gas.

21. Zinc Works

Works in which by the application of heat, zinc is extracted from the ore, or from any residue containing that metal, and works in which compounds of zinc are made by dry processes giving rise to fume.

22. Benzene Works

Works [not being tar works as already defined] in which any wash oil used for the scrubbing of coal gas is distilled, or in which any crude benzol is distilled.

23. Pyridine Works

Works in which pyridine or picolines are recovered or made.

24. Bromine Works

Works in which bromine is made or is used in any manufacturing operation.

25. Hydrofluoric Acid Works

Works in which hydrofluoric acid is evolved in the manufacture of liquid hydrofluoric acid or its compounds.

26. Cement Production Works

Works in which argillaceous and calcareous materials are used in the production of cement clinker and works in which cement clinker is ground or cement is packed.

27. Lead Works

Works [not being works for the recovery of lead from scrap by direct liquation] in which, by the application of heat, lead is extracted from any material containing lead or its compounds, and works in which compounds of lead are manufactured from metallic lead or its compounds by dry processes which give rise to dust or fume.

28. Fluorine Works

Works in which fluorine or its compounds with other halogens are made or used in any manufacturing process, and works for the manufacture of fluorides, borofluorides or silicofluorides.

29. Acid Sludge Works

Works in which acid sludge produced in the refining of coal tar, petroleum or other hydrocarbon derivatives is treated in such manner as to cause the evolution of any noxious or offensive gas.

30. Iron Works and Steel Works

Works in which:

(*a*) iron or ferro-alloys are produced in a blast furnace and in which raw materials for use in blast furnaces are handled or prepared; or

(*b*) iron ores for use in blast furnaces are calcined or sintered; or

(*c*) iron or steel is melted in cupolas employing a heated air blast, or in electric arc furnaces; or

(*d*) steel is produced, melted or refined in Bessemer, Tropenas, open hearth or electric arc furnaces; or

(*e*) oxygen or air enriched with oxygen is used for the refining of iron or for the production, shaping or finishing of steels; or

(*f*) ferro-alloys are made by processes giving rise to fume.

31. Copper Works

Works in which:

(*a*) by the application of heat
  (i) copper is extracted from any ore or concentrate or from any material containing copper or its compounds; or
  (ii) molten copper is refined; or
  (iii) copper or copper alloy swarf is degreased; or
  (iv) copper alloys are recovered from scrap fabricated metal, swarf or residues by processes designed to reduce the zinc content; or

(*b*) copper or copper alloy is melted and cast in moulds the internal surfaces of which have been coated with grease-bound or oil-bound dressings. [But this paragraph does not apply to works in which the aggregate casting capacity does not exceed 10 tons per day.]

32. Aluminium Works

Works in which:

(*a*) aluminium swarf is degreased by the application of heat; or

(*b*) aluminium or aluminium alloys are recovered from aluminium or aluminium alloy scrap fabricated metal, swarf, skimmings, drosses or other residues by melting but not including works in which aluminium or aluminium alloys are separated from ferrous metals by liquation in sloping heater furnaces; or

(*c*) aluminium is recovered from slag; or

(*d*) molten aluminium or aluminium alloys are treated by any process involving the evolution of chlorine or its compounds; or

(*e*) aluminium is extracted from any material containing aluminium by a process evolving any noxious or offensive gases; or

(*f*) oxide of aluminium is extracted from any ore

and materials used in the above processes or the products thereof are treated or handled by methods which cause noxious or offensive gases to be evolved.

33. Electricity Works

Works in which:

(*a*) solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of public transport; or

(*b*) boilers having an aggregate maximum continuous rating of not less than 450,000 lbs. of steam per hour and normally fired by solid or liquid fuel are used to produce steam for the generation of electricity for purposes other than those mentioned in the preceding paragraph.

34. Producer Gas Works

Works in which producer gas is made from coal and in which raw producer gas is transmitted or used.

35. Gas and Coke Works

Works [not being producer gas works] in which:

(*a*) coal, oil or mixtures of coal or oil with other carbonaceous materials or products of petroleum refining or natural gas or methane from coalmines or gas derived from fermentation of carbonaceous materials are handled or prepared for carbonisation or gasification or reforming and in which these materials are subsequently carbonised or gasified or reformed; or

(*b*) Water gas is produced or purified; or

(*c*) coke or semi-coke is produced and quenched, cut, crushed or graded; or

(*d*) gases derived from any process mentioned in paragraph (*a*) are subjected to purification processes.

36. Ceramic Works

Works in which:

(*a*) pottery products [including domestic earthenware and china sanitary ware, electrical porcelain, glazed tiles and teapots] are made in intermittent kilns fired by coal or oil; or

(*b*) heavy clay or refractory goods are fired by coal or oil in
  (i) intermittent kilns; or
  (ii) continuous grate-fired kilns, not being tunnel kilns; or
  (iii) any kiln in which a reducing atmosphere is essential; or

(*c*) salt glazing of any earthenware or clay material is carried on.

37. Lime Works

Works in which calcium carbonate or calcium-magnesium carbonate is burnt through the agency of coal or oil.

38. Sulphate Reduction Works

Works in which metallic sulphates are reduced to the corresponding sulphides by heating with carbonaceous matter.

39. Caustic Soda Works

Works in which:

(*a*) either concentrated solutions of caustic soda or fused caustic soda are produced in vessels heated by coal; or

(*b*) black liquor produced in the manufacture of paper is calcined in the recovery of caustic soda.

40. Chemical Incineration Works

Works for the destruction by burning of wastes produced in the course of organic chemical reactions which occur during the manufacture of materials for the fabrication of plastics and fibres, and works for the destruction by burning of chemical wastes containing combined chlorine, fluorine, nitrogen, phosphorus or sulphur.

41. Uranium Works

Works [not being works licensed under the Nuclear Installations [Licensing and Insurance] Act, 1959, and not being nuclear reactors or works involving the processing of irradiated fuel therefrom for the purpose of removing fission products] in which:

(*a*) any ore or concentrate or any material containing uranium or its compounds is treated for the production of uranium or its alloys or its compounds; or

(*b*) any volatile compounds of uranium are manufactured or used; or

(*c*) uranium or its compounds are manufactured, fashioned or fabricated by any dry process giving rise to dust or fume.

42. Beryllium Works

Works in which:

(*a*) any ore or concentrate or any materal containing beryllium or its compounds is treated for the production of beryllium or its alloys or its compounds; or,

(*b*) any material containing beryllium or its alloys or its compounds is treated, processed or fabricated in any manner giving rise to dust or fume.

43. Selenium Works

Works in which:

(*a*) any ore or concentrate or any material containing selenium or its compounds is treated for the production of selenium or its alloys or its compounds; or

(*b*) any material containing selenium or its alloys or its compounds other than as colouring matter is treated, processed or fabricated in any manner giving rise to dust or fume.

44. Phosphorus Works

Works in which:

(*a*) phosphorus is made; or

(*b*) yellow phosphorus is used in any chemical or metallurgical process.

45. Ammonia Works

Works in which ammonia is:

(*a*) made; or

(*b*) used in the ammonia-soda process; or

(*c*) used in the manufacture of carbonate, nitrate or phosphate of ammonia or urea or nitriles.

46. Hydrogen Cyanide Works

Works in which hydrogen cyanide is made or is used in any chemical manufacturing process.

47. Acetylene Works

Works in which acetylene is made and used in any chemical manufacturing process.

Section 3

Air Pollution Research Programmes in the United Kingdom

The following information is published by courtesy of the Interdepartmental Committee on Air Pollution Research, and is largely based on information supplied by the research organisations involved.

The table lists all research known to be in progress in 1971-2 and either partly or wholly funded by the government but it does not claim to be either exhaustive or fully up-to-date. It also includes some industrial organisations known to be concerned with air pollution research, but no attempt has been made to make it complete in this respect.

The programmes are arranged by subject in five parts, viz:

Part 1: Abatement of Emissions of Pollutants

Part 2: Dispersion and Distribution of Pollutants

Part 3: Effects on Health

Part 4: Effects on Animal Life, Vegetation and Materials

Part 5: Measurement Methods

(Addresses of organisations which occur several times are given at the end of the list).

Problem		*Investigation*	*Organisation*	*Officer Responsible*
Part 1. Abatement of Emissions of Pollutants				
1.1 Sulphur compounds	(a)	Removal from gases in fluid bed combustion systems	N.C.B., Coal Research Establishment	—
	(b)	Assessment of processes for removal of SO_2 from flue gases	C.E.G.B.	—
	(c)	Desulphurisation of combustion gases during combustion, using fluidised bed of lime particles	Esso	—
	(d)	Study of effectiveness of lime for treatment of acidic flue gases	Welwyn Hall Research Association, Church Street, Welwyn, Herts.	—
	(e)	Desulphurisation of residual feedstocks and fuel-oil blending components	B.P.	Manager
	(f)	Study of sulphur retention in fluidised bed combustion. (In collaboration with BCURA Ltd.)	B.P.	Manager
1.2 Grit and dust	(a)	Identification of grit and dust	W.S.L.	—
	(b)	Measurement of emission from chimneys	W.S.L. (for S.D.D.)	—
	(c)	Development of mechanised ash removal systems	N.C.B., Coal Research Establishment	—
	(d)	Grit, dust and fume in foundries and factors influencing concentrations and characteristics; sampling methods; exhaust systems; improvement of ventilation and fume in steelmaking	Steel Castings Research and Trade Association, East Bank Road, Sheffield S2 3PT	Dr. H. T. Hall (Director)
	(e)	Development of more efficient gas cleaning systems	British Steel Corporation, Corporate Laboratories	—

Problem		*Investigation*	*Organisation*	*Officer Responsible*
	(f)	Measurement of emissions of pollution from steelworks plant; specification of equipment to reduce it; improving performance and efficiency of extraction systems	British Steel Corporation, Operating Divisions	—
	(g)	Improvement in electrostatic precipitation	C.E.G.B.	—
	(h)	Reduction of pollution due to ash disposal	C.E.G.B.	—
1.3 Air pollution from combustion	(a)	Determination of emission levels of gas products from natural gaseous flames under various experimental conditions	Gas Council	—
	(b)	Control of diesel combustion products and noise by use of intake additives	London University: University College, Dept. of Mechanical Engineering, Torrington Place, London W.C.1	Professor H. Billett
	(c)	Reduction in emissions of nitrogen oxides from continuous combustion systems	Shell	—
	(d)	Development of improved flare design	B.P.	Manager
	(e)	Investigations into improvement of combustion in domestic and industrial oil-fired equipment with particular reference to solids, (NO_x), and unburnts	B.P.	Manager
	(e)	Study of formation of nitric oxide in methane and other flames and of additives to reduce nitric oxide formation	Shell	—
	(f)	Gas turbine emissions: effect of fuel composition, engine characteristics and operation	Shell	—
	(g)	Study of growth of smoke particles, using model systems and shock tube techniques	Shell	—
	(h)	Studies of emissions from stationary oil-fired sources ranging from space heaters and power station boilers to steel and chemical manufacturing plant	Esso	—
1.4 Particulates	(a)	Research on fibrous filters and improvements of test methods	Ministry of Defence, Chemical Defence Establishment	—
1.5 Asbestos	(a)	Development of fibre-reinforced inorganic materials not containing asbestos	Building Research Station, Garston, Watford, Herts.	J. B. Dick (Director)
1.6 Brickworks, etc.	(a)	Reduction of smoke during firing of blue engineering bricks, roofing tiles and floor quarries, of fume during salting period in firing salt-glazed pipes, of acid soot and fumes especially from oil-fired kilns and/or when firing sulphur-bearing clays in the structural ceramic and refractories industry and of fluorine from pottery kilns	British Ceramic Research Association, Queens Road, Penkhull, Stoke-on-Trent ST4 7LQ	Dr. N. F. Astbury
	(b)	Overcoming health hazard from dust in clay industries	British Ceramic Research Association, Queens Road, Penkhull, Stoke-on-Trent ST4 7LQ	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
1.7 Welding and flame cutting	(a) Study of toxic thermal degradation products	University of Newcastle-upon-Tyne, Dept. of Industrial Health, 21 Claremont Place, London NE2 4AA	Professor R. C. Browne
1.8 Coking plant	(a) Reduction of smoke emissions during oven charging; measurement, including development of methods; abatement of pollutants	British Coke Research Association, Chesterfield, Derbyshire	J. P. Graham
1.9 Industrial plant, especially copper and aluminium works	(a) Extended survey of sources of fuel emissions; data collection on composition and mass emission of fume; further pilot scale tests of collection equipment together with economic evaluations; advisory services	British Non-Ferrous Metals Research Association, Euston Street, London NW1 2EU	Dr. A. J. Kennedy
1.10 Motor vehicles	(a) Diesel		
	(i) measurement and reduction of smoke	London University: Queen Mary College, Dept. of Mechanical Engineering, Mile End Road, London E.1	Professor M. W. Thring
	(ii) measurement and reduction of smoke	W.S.L.	—
	(iii) measurement of smoke, and type testing of opacimeters; measurement of gaseous emissions	M.I.R.A.	—
	(b) (i) Exhaust emissions from petrol engines: effect of combustion chamber design; assessment of different measuring procedures; completion of assessment of exhaust gas recirculation	M.I.R.A.	—
	(ii) Removal of lead from exhaust gases by filtration	W.S.L.	—
	(iii) Removal of CO, NO_2, hydrocarbons from exhaust gases by catalytic devices	W.S.L.	—
	(iv) Petrol engine exhaust gases: reduction of pollution from, with emphasis on nitrogen oxides	Burmah-Castrol Co.	—
	(v) Supply of oils to Ford and General Motors for testing effect of lubricating oils on emissions from cars fitted with catalytic exhaust systems	Burmah-Castrol Co.	—
	(vi) Co-operative studies (with U.K. motor industry) on emissions from cars; including use of dynamometer capable of operation at temperatures down to —30° F, and study of effects on motor fuel composition and vehicle performance of reduction of lead in motor fuels	B.P.	Manager
	(vii) Study of formation of nitric oxide in gasoline engines, and of additives for reduction of nitric oxide formation	Shell	—
	(viii) Injection of air into engine exhaust systems; shock tube studies on co-oxidation of CO and Hydrocarbons	Shell	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(ix) Study of emission of nitrogen oxides, CO and unburnt hydrocarbons from exhausts of petrol engines in relation to fuel and engine factors; fuel requirements of emission-controlled engines	Shell	—
	(x) Development of petrol-powered cars with acceptably low emissions by means of engine modifications, exhaust manifold reaction, and exhaust gas recycle. Study of effect of fuel quality on emissions	Esso	—
	(c) Isolation of aromatic hydrocarbons from petroleum	(i) Exeter University, Department of Chemistry (with M.R.C. grant)	—
		(ii) Manchester University, Institute of Science and Technology, Dept. of Chemical Engineering (M.R.C. grant)	—
	(d) Combination of steam-powered prime mover and hydrostatic transmission unit to exploit inherent low pollutant characteristics of external combustion unit	National Engineering Laboratory, East Kilbride, Glasgow	R. H. Weir (Director)
1.11 Aircraft (see also 5k)	(a) Production and consumption of pollutants from rich hydrocarbon/air flames, at high pressures, with particular reference to aircraft gas turbine conditions	National Gas Turbine Establishment, Pyestock, Farnborough, Hants.	I. M. Davidson
1.12 Domestic smoke	(a) Production of solid smokeless fuels: production scale work on carbonisation of small coal in a fluidised bed followed by briquetting of char without a binder, and on briquetting of high rank coal with pitch, followed by a mild heat treatment	N.C.B. Coal Research Establishment	—
	(b) Development of domestic appliances (room heaters and domestic central heating boilers) for burning small graded bituminous coal smokelessly	N.C.B. Coal Research Establishment	—
	(c) Measurement of smoke emission from solid fuel-fired appliances and from manufactured solid fuels	N.C.B. Coal Research Establishment	—
	(d) Measurement of smoke emission from oil-fired appliances and from fuel oils	B.P.	Manager
1.13 Odours	(a) Abatement of manure drying odours, etc.	W.S.L.	—
1.14 Hydrocarbon Emissions	(a) Measurement of hydrocarbon emissions from petroleum handling problems	B.P.	Manager
1.15 Pollution Control	(a) Analysis of causes and effects of existing and potential air pollution problems	B.P.	Manager
	(b) Assessment of flue gas desulphurization processes	B.P.	Manager

Problem	*Investigation*	*Organisation*	*Officer Responsible*
Part 2. Dispersion and Distribution of Pollutants			
2.1 Study of dispersion of chimney gases in order to minimise pollution by correct design and siting of chimneys	(a) High isolated chimneys: surveys round power stations	C.E.G.B.	—
	(b) High chimneys in built-up areas: wind tunnel and full scale studies	University of Bristol, Dept. of Aeronautical Engineering (under contract to C.E.G.B.)	T. V. Lawson
	(c) Chimney design in relation to nearby buildings: wind tunnel studies	University of Bristol, Dept. of Aeronautical Engineering (under contracts)	T. V. Lawson
	(d) Chimney design in relation to nearby buildings: comparison of wind tunnel and full scale tests	W.S.L.	—
	(e) Theoretical and experimental investigation, using wind tunnels, into turbulent flows near typical building shapes and effect of these flows on local dispersion of airborne pollution	University of Cambridge, Dept. of Applied Mathematics and Theoretical Physics, and Dept. of Engineering, Silver Street, Cambridge CB3 9EW	Dr. J. C. R. Hunt Dr. P. J. Mulhearn Dr. J. C. Mumford
	(f) Theoretical treatment of dispersion from stacks	B.P.	—
	(g) Measurement and advice on control of emissions from industrial chimneys	B.P.	Manager
	(h) Advice on the fundamentals of design of industrial chimneys	B.P.	Manager
	(j) Wind tunnel study of atmospheric diffusion of smoke plume from chimney stack	Brighton Polytechnic, Dept. of Applied Physics, Moulsecoomb, Brighton BN2 4GJ	P. Bradshaw
	(k) Emission and dispersion of smoke fumes from ships' funnels and industrial chimneys; wind tunnel tests	N.P.L., Division of Maritime Science	—
	(l) Wind tunnel studies for built-up areas	C.E.G.B.	—
	(m) Use of vortex rings to obtain very large rise for pollution, and allow use of low chimneys	British Hydromechanics Research Association, Cranfield, Bedford	G. F. W. Adler (Director of Research)
2.2 Case studies	(a) Studies include: (i) Supercooled fog on a proposed cooling lagoon at Connah's Quay (ii) SO_2 in the City of London and effects of architectural structure (iii) Dust on urban motorways (iv) Dispersion of odours from an urban source (v) Effects of details of local wind behaviour on dispersion of gases from Holyhead aluminium works, and meaningfulness of averages	London University: Imperial College of Science and Technology, Dept. of Mathematics, Exhibition Road, London SW7 (with S.R.C. support)	Professor R. S. Scorer
2.3 Studies of dispersion	(a) Dispersion of products of combustion	Gas Council	—

Problem		*Investigation*	*Organisation*	*Officer Responsible*
	(b)	Application of tracer gases to determination of ventilation patterns in areas ranging from rooms to towns	Esso	—
	(c)	Dispersion of pollutants from European refinery complex	B.P. for CONCAWE	—
	(d)	Measurement of SO_2 round Burmah refinery, Ellesmere Port, to determine effect on rural and urban G.L.C.	Burmah-Castrol Co.	—
2.4 Studies of dispersion and of the influence of meteorological factors	(a)	Estimation of concentration of pollutants from specified source under wide range of weather conditions	Met. Office	—
	(b)	Estimation of the concentration of a pollutant from specified source as a function of distance and weather conditions	Ministry of Defence, Chemical Defence Establishment	—
	(c)	Long-range transport and dispersion of sulphur dioxide	W.S.L.	—
	(d)	Surveys and analysis of the contributions of various classes of fuel usage to ground level pollution with reference to location and meteorological conditions	Esso	—
2.5 Studies of dispersion and of meteorological factors in the upper air over town and country	(a)	Study of atmospheric turbulence and convection in first few thousand feet above ground, using instruments on towers or on tethered balloons; study of vertical temperature, wind and humidity up to 4,000 ft. using radiosondes, free or on tethered balloons	Met. Office	—
2.6 Studies of dispersion on global scale	(a)	Monitoring of radioactive debris from nuclear explosions	A.E.R.E.	—
	(b)	Application of radioactive techniques to, e.g. diffusion in stratosphere	A.E.R.E.	—
	(c)	Development of models of worldwide atmospheric circulation and climate with possible future applications to studies of the dispersal of pollutants	Met. Office	—
	(d)	Measurement of SO_2 over the North Sea (Further studies are being considered in conjunction with Government bodies)	B.P.	Manager
2.7 Trends in global pollution	(a)	Investigation of dated Antarctic ice cores to give historical evidence of air-borne substances	British Antarctic Survey, Scott Polar Institute (supported by N.E.R.C. and D.E.S.), 30 Gillingham Street, London SW1	Sir Vivian Fuchs
2.8 Distribution of pollutants throughout the United Kingdom, especially in relation to application of the Clean Air Act	(a)	The National Survey of Smoke and Sulphur Dioxide	W.S.L. in co-operation with Local Authorities, the C.E.G.B. and other organisations	—
2.9 Distribution of pollutants throughout the United Kingdom	(a)	Metals: (i) survey of relative burdens of atmospherically borne metals in Britain	University of Wales, Swansea, Dept. of Botany	G. Goodman
		(ii) environmental analysis: trace metals in air	A.E.R.E.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
2.10 Distribution of pollution in urban areas in relation to meteorological and geographical factors and to the needs of medical investigators, town planners, etc.	(a) Using National Survey and meteorological data, reformulation of operational forecasting scheme for high concentrations of SO_2 in London, and investigation of applicability of scheme to other cities	Met. Office	—
	(b) Sheffield: Analysis of pollution trends in relation to smoke control and changing fuel usages; effect of introduction of North Sea gas; incidence of pulses of high SO_2; effect of met. conditions on pollution and vice versa; weather and diurnal smoke, SO_2 patterns; SO_2 and health	Sheffield University, Dept. of Geography, Air Pollution Unit, and the Gas Council	Professor Alice Garnett
	(c) London: with particular reference to temperature and air flow and application of trend surface analysis	London University: University College, Dept. of Geography, Gower Street, London W.C.1	Professor T. J. Chandler
	(d) Brighton: with particular reference to temperature	London University: University College, Dept. of Geography, Gower Street, London W.C.1	—
	(e) Modelling of pollution	W.S.L.	
	(f) Pollution by traffic: (i) improvement of predictive equations for CO (and for other environmental factors) in urban streets	London University: Imperial College of Science and Technology, Dept. of Civil Engineering, Imperial Institute Road, London S.W.7	D. H. Crompton
	(ii) monitoring of malodorous traffic pollutants	London University: Imperial College of Science and Technology, Dept. of Civil Engineering, Imperial Institute Road, London S.W.7	—
	(iii) survey in five towns	W.S.L.	—
	(g) Special surveys at chosen locations to identify and determine gaseous pollutants	Ministry of Defence, Chemical Defence Establishment	—
	(h) Studies of the sensitivity and applicability of lidar to the detection of aerosols in the atmosphere	Ministry of Defence, Chemical Defence Establishment	—
	(j) Measurement of SO_2 and particulates in 4 European cities to determine relative contributions of industrial and space heating sources to urban air quality. Data analysis in terms of fuel patterns, population distribution and meteorology	Esso	—
	(k) Correlation of SO_2 concentrations in British towns and cities with fuel consumption	B.P. for Institute of Petroleum	—
2.11 Distribution of pollution in rural areas	(a) Continuous monitoring (at Porton) of rural atmosphere for presence of organophosphorus pesticides	Ministry of Defence, Chemical Defence Establishment	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Monitoring of trace elements in rainwater at six sites	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service	Regional Officers
2.12 Pollutants in remote areas	(a) Sulphur, chlorine, sodium, potassium, calcium, magnesium, ammonia, in air and in rain; NO_3 and H_2CO_3 in rain; measurements at three sites	Met. Office (analysis by the Government Chemist)	—
	(b) Distribution of air pollution in the New Forest with particular reference to lichen distribution	Portsmouth College of Technology, Dept. of Biological Sciences, Park Road, Portsmouth, Hants.	F. N. Haynes
	(c) Sulphur dioxide and smoke in air	W.S.L.	—
2.13 Pollution from aircraft	(a) Surveys of pollution at ground level at and near airports	W.S.L.	—
2.14 Distribution of pollutants from specific sources	(a) Lead	W.S.L.	—
	(b) Fluorine: at Invergordon	W.S.L. (for S.D.D.)	—
2.15 Pollution from motorways (see also 2.2(iii))	(a) Dust fall in the vicinity of motorways	University of Reading, Dept. of Geography, Whiteknights, Reading RG6 2AF	M. Parry
2.16 Air pollution in relation to climate, etc.	(a) Measurement of radiative properties of cloud, fog and haze	N.E.R.C. and Oxford University, Dept of Atmospheric Physics	Dr. J. T. Houghton
	(b) Effect of air pollution on income of short wave radiation at the surface, and on radiation balance	University of Nottingham, School of Agriculture, Dept. of Physiology and Environmental Studies, Sutton Bonington, Loughborough	Professor J. L. Monteith
	(c) Evaporation from a catchment in relation to air pollution	University of Nottingham, School of Agriculture, Dept. of Physiology and Environmental Studies, Sutton Bonington, Loughborough (sponsored by N.E.R.C.)	Professor J. L. Monteith
	(d) Concentrations of smoke and SO_2 in rural areas of England and Wales in relation to climatological and geographical factors	London University: University College, Dept. of Geography	Professor T. J. Chandler
	(e) Aerobiology in relation to forest disease development	Oxford University, Forestry Dept.	R. G. Pawsey Dr. T. W. Tinsley
	(f) Relationship between visibility, relative humidity, droplet population and particulate pollutants	A.E.R.E.	—
	(g) (i) investigation of the geographical distribution of mist on Teeside and the correlation between visibility, chemical composition of the atmospheric aerosol and other meteorological factors; (ii) measurement of ammonia and SO_2 levels on Teesside to study the kinetics of their conversion to ammonium sulphate, a major contribution to the mist; identification of the meteorological and other factors which assist the conversion;	A.E.R.E.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(iii) comparison measurements of ammonia, SO_2, ammonium sulphate and other particulates at other sites in the country; (iv) laboratory investigations of the kinetics of both the homogeneous and heterogeneous formation of ammonium sulphate from ammonia and SO_2		
	(h) Relationship between pollution and rainfall	London University: University College, Dept. of Geography	Professor T. J. Chandler
2.17 Life-history of pollutants in the atmosphere	(a) Laboratory and field studies of SO_2 oxidation by catalytic mechanisms and photochemical reactions in the presence of hydrocarbons and oxides of nitrogen	A.E.R.E.	—
	(b) Condensed particles derived from gaseous pollutants; mists: (i) kinetics of aerosol formation from SO_2 and NH_3 and from other gases; (ii) kinetics of growth of H_2SO_4 droplets in conditions analogous to (a) the respiratory system, and (b) mists occurring in manufacture of the acid	London University: Imperial College, Dept. of Chemical Engineering and Chemical Technology, Prince Consort Road, London S.W.7	Dr. M. J. G. Wilson
	(c) Dispersion of major pollutants: fate of SO_2 in atmosphere: chemical changes, mechanisms of removal and their interaction with dispersion on all scales	London University: Imperial College of Science and Technology, Dept. of Mathematics (with support of Shell)	Professor R. S. Scorer
	(d) Chemistry and fate in atmosphere of SO_2, NO etc.	C.E.G.B.	—
	(e) Study of haze which reduces visibility and sunlight on dry days in rural areas	Shell	—
2.18 Bactericidal properties of pollutants	(a) Studies of bactericidal properties of pollutants in urban areas with reference to recognition of the presence of olefin-ozone reaction products	Ministry of Defence, Microbiological Research Establishment	—
2.19 Studies in air pollution	No details available	Gas Council	—
2.20 Sulphur and the land	(a) Assessment of sulphur reaching the land in Britain	C.E.G.B.	—
2.21	(a) Atmospheric submicron aerosol as related to measurement of air quality	University of Cambridge, Dept. of Physics (N.E.R.C. grant)	—
2.22	(a) Halomethane in atmosphere	University of Reading (N.E.R.C. grant)	—
Part 3. **Effects on Health** Medical research to indict as far as possible specific pollutants responsible for ill effects on health and to suggest maximum levels of tolerance			
3.1 Specific pollutants	(a) The recognition of industrial and other pollution and pathogenic particles	University College of South Wales and Monmouthsire, Dept. of Mineral Exploitation	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(b) Inhalation of aerosols by man:	University of Essex, Dept. of Chemistry (M.R.C. External Scientific Staff)	—
		University of Essex, Dept. of Chemistry (M.R.C. grant)	
	(c) Study of effects of emissions from motor vehicles	M.R.C., Air Pollution Unit	—
	(d) Physiological effects of chronic exposure to carbon monoxide	Surrey University, Dept. of Biological Sciences (M.R.C. grant)	—
	(e) Immunochemical analyses of fungal and other glycopeptides	Institute of Diseases of the Chest, Dept. of Clinical Immunology (M.R.C. grant)	—
	(f) Tobacco smoke: relationship between sugar content of tobacco and pH of smoke, for cigarettes, cigar and pipe tobaccos and relationship to toxicity and lung cancer risks of smoking	London University: Institute of Cancer Research, Biophysics Dept., Chester Beatty Institute, Fulham Road, London S.W.3	The Director
	(g) Antimony: effect of antimony dust on the lungs	University of Newcastle-upon-Tyne, Dept. of Industrial Health	Professor R. C. Browne
	(h) Asbestos:		
	(i) effects	M.R.C., Pneumoconiosis Unit	—
	(ii) asbestos-related disease in a ship building community; incidence and complications in Barrow-in-Furness	Barrow-in-Furness Hospital (M.R.C. grant)	—
	(iii) mortality studies of male and female asbestos factory workers	London School of Hygiene & Tropical Medicine, Keppel Street, London W.C.1 (M.R.C. grant)	Professor D. D. Reid
	(iv) immunological changes associated with pleural plaque formation and mesothelioma in a community potentially exposed to asbestos	Barrow-in-Furness North Lonsdale Hospital, Pathology Laboratory	—
	(v) pleural changes occurring in a population potentially exposed to asbestos	Barrow-in-Furness North Lonsdale Hospital, Pathology Laboratory (M.R.C. grant)	—
	(vi) modification of the effects of asbestos and related dusts in tissues	Reading University (M.R.C. grant)	—
	(vii) study of solubility of asbestos *in vivo* and the use of induced radio-activity to investigate the fate of inhaled and ingested asbestos fibres	A.E.R.E.	—
	(viii) follow-up of boiler and steam pipe insulaters exposed to asbestos in the past	University of Newcastle-upon-Tyne, Dept. of Industrial Health	Professor R. C. Browne
	(ix) concurrent study of changes in pathology in respiratory function in guinea pigs exposed to asbestos dust	University of Manchester, Dept. of Occupational Health, Clinical Sciences Building, York Place, Manchester M13 0JJ	Professor W. R. Lee
	(j) Benzene: effect of benzene in atmosphere on health	B.P., in co-operation with other companies for Institute of Petroleum	—

Problem		*Investigation*	*Organisation*	*Officer Responsible*
	(k)	Chemistry and biochemistry of interaction of benzpyrene and related carcinogens with D.N.A., R.N.A. and their components	Sheffield University, Dept. of Chemistry	—
3.2 Occupational health	(a)	Physiological effects of industrial dusts	M.R.C., Pneumoconiosis Unit	—
	(b)	Pneumoconiosis of coal workers: application of radiography, lung function and morbid anatomy to study the different subgroups of the condition	M.R.C., Pneumoconiosis Unit	—
	(c)	Cotton and other vegetable dusts, including farmers' lung	M.R.C., Pneumoconiosis Unit	—
	(d)	Byssionosis: determination of particle size distribution and analysis of different size fractions of cotton card-room dust	University of Manchester, Dept. of Occupational Health, Clinical Sciences Building, York Place, Manchester M13 0JJ	Professor W. R. Lee
	(e)	Pharmacological properties of cotton and other vegetable fibre dusts in relation to the acute symptoms of byssinosis	Cardiff Institute of Science and Technology (M.R.C. grant)	—
	(f)	Influence of duration and intensity of exposure on the elimination of high and low rank coal dusts	University of Newcastle-upon-Tyne, Dept. of Pathology (M.R.C. grant)	—
	(g)	Relation of composition of welding rods to fumes produced in welding	University of Newcastle-upon-Tyne, Dept. of Industrial Health	Professor R. C. Browne
	(h)	Absorption of inhaled chlorinated and fluorinated hydrocarbon vapours and their subsequent excretion in breath using ^{38}C1 tracer techniques	A.E.R.E.	—
	(j)	Monitoring of potentially hazardous and uncomfortable environments within working locations	B.P.	Manager
3.3 Studies of lung function, etc.	(a)	Theoretical study of lungs and pneumatic system	M.R.C., Air Pollution Unit	—
	(b)	Investigation of effects of pollutants in pulmonary function	M.R.C., Air Pollution Unit	—
	(c)	Analysis of respiratory wave forms using on-line computer techniques	M.R.C., Air Pollution Unit	—
	(d)	The effects of air pollutants on the growth and morphology of respiratory pathogens	M.R.C., Air Pollution Unit	—
	(e)	Preclinical stages of chronic bronchitis (smoking habits and effects of air pollution)	London Royal Postgraduate Medical School (M.R.C. grant)	—
	(f)	Factors affecting the deposition and clearance of particulate material from the human nose using radioactive tracer techniques	A.E.R.E.	—
	(g)	Correlation between lung disease and respirable dust	Safety in Mines Research Establishment, Red Hill, Broad Lane, Sheffield	Dr. C. A. A. Wass

Problem		*Investigation*	*Organisation*	*Officer Responsible*
3.4 Epidemiology	(a)	Variations in mortality, in the demands for hospital admission and in the clinical condition of patients with chronic bronchitis and emphysema in relation to daily changes in weather and air pollution	M.R.C., Air Pollution Unit	—
	(b)	Daily variation in the respiratory function of normal subjects	M.R.C., Air Pollution Unit	—
	(c)	Surveys of respiratory symptoms and ventilatory capacity in relation to smoking and air pollution	M.R.C., Air Pollution Unit	—
	(d)	Analysis of data on lung cancer mortality in relation to urban factors	M.R.C., Air Pollution Unit	—
	(e)	Studies of effects of air pollution	Dept. of Health and Social Security, Alexander Fleming House, Elephant and Castle, London S.E.1	Dr. A. E. Martin
	(f)	Respiratory disease and function in young families in Harrow, and in school-children in Kent	London University: St. Thomas's Hospital Medical School, Dept. of Clinical Epidemiology and Social Medicine, London S.E.1	Professor W. W. Holland
	(g)	Chronic respiratory diseases in relation to pollution and smoking in the U.K.: international studies in Britain, U.S. and Norway with particular reference to migrants from Britain; upper and lower respiratory tract disorders in town and country children	London University: London School of Hygiene and Tropical Medicine, Dept. of Medical Statistics and Epidemiology, Keppell Street, London W.C.1	Professor D. D. Reid
	(h)	Effects of dust, containing spores from mouldy hay/grain, on the lungs of farmers in Scotland	University of Dundee, Dept. of Social and Occupational Medicine	Professor A. Mair
Part 4. Effects on Animal Life, Vegetation and Materials				
4.1 Animal Life	(a)	Fluorosis in farm animals	Ministry of Agriculture, Fisheries and Food, Central Veterinary Laboratory, New Haw, Weybridge, Surrey	Dr. A. B. Paterson
	(b)	Agricultural significance of airborne pollution by lead and other elements from industrial sources (several centres)	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service	—
	(c)	Industrial melanism in the Manchester area	University of Manchester, Dept. of Zoology (N.E.R.C. grant)	—
	(d)	Adverse effect of airborne heavy metals and other metallic ions upon metabolism of essential trace elements in animals	Rowett Research Institute, Bucksburn, Aberdeen	Dr. K. L. Blaxter
4.2 Vegetation (see also 4.1(b))	(a)	Lichens and bryophytes: (i) Use of lichens as indicators of distribution of air pollution; distribution of latter in relation to topography	London University: King's College, Dept. of Geography, Strand, London W.C.2	Dr. F. Rose

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(ii) effect of sulphite and sulphate on lichens, with reference to air pollution	University of Newcastle-upon-Tyne, Dept. of Botany	D. J. Hill
	(iii) effect of air-borne fluorides on lichens, bryophytes and higher plants	Sheffield University, Dept. of Landscape Architecture	Dr. O. L. Gilbert
	(iv) ecological effects of air pollution on epiphytes and the phenomenon of industrial melanism in insects	University College, Cardiff, Dept. of Zoology	Dr. E. R. Creed
	(v) effect of air pollution on the establishment of bryophyte spores on tree barks	London University: Queen Mary College, Dept. of Plant Biology and Microbiology, Mile End Road, London E.1	Dr. P. J. Wanstall
	(vi) Distribution of lichens in vicinity of aluminium smelter, Anglesey	Nature Conservancy, Bangor	—
	(b) Uptake of SO_2 by vegetation	A.E.R.E.	
	(c) Effect of SO_2 on yields of rye grass	A.E.R.E. and London University: Imperial College of Science and Technology	—
	(d) Contamination of plants and soils by lead and other trace elements as a result of atmospheric pollution	Macaulay Institute for Soil Research, Cragiebuckler, Aberdeen	Dr. R. L. Mitchen
	(e) Effects of (i) smoke in suspension, (ii) SO_2 in atmosphere; husbandry practices to alleviate effects; field studies	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Great House Experimental Husbandry Farm, Helmshore, Passerdale, Lancs.	C. H. Mudd
	(f) Effects of nearby major source of air pollution on deciduous woodland	University of Wales: Cardiff Institute of Science Technology, Dept. of Applied Biology, Cathays Park, Cardiff, Wales (sponsored by N.E.R.C.)	Professor R. W. Edwards
	(g) Growth of trees in the Pennines in relation to air pollution	Forestry Commission, Research Division, Alice Holt Lodge, Wrecclesham, Farnham, Surrey	Dr. D. H. Phillips
	(h) Effects of pollution from an aluminium smelter on the surrounding forest area	Forestry Commission	—
	(j) Effects of sulphur dioxide and heavy metals on angiosperms	Plymouth Polytechnic, Dept. of Environmental Sciences	Dr. F. B. Pyatt
	(k) Effects of air pollution on plant growth in glasshouses	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Lee Valley Experimental Horticulture Station, Ware Road, Hoddesdon, Herts.	P. G. Allen
	(l) Methods of cleaning glass	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Lee Valley Experimental Horticulture Station, Ware Road, Hoddesdon, Herts.	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(m) General evaluation of the field and formulation of general pollutant/damage functions	Manchester University, Pollution Research Unit, Mathematics Building, Oxford Road, Manchester M13 9PL	Dr. N. Lee
	(n) Responses of lower plants to pollutants from internal combustion engines; effects on metabolic sites, photosynthesis	Aberdeen University, Dept. of Botany	—
	(o) Effects of gaseous atmospheric pollution on plants	Sheffield University, Dept. of Botany	—
4.3 Materials	(a) Effect of air pollution as a factor in the durability of building materials (stone, concrete, surface coatings, plastics, metals, fired clay products)		
	(i) dirt adhesion and removal on silicate-based materials	University of Cambridge, Dept. of Surface Physics, Cavendish Laboratory, Free School Lane, Cambridge (under contract from D.O.E., Building Research Station)	Professor Tabor
	(ii) dirt pick-up on paint	Paint Research Station (under contract from D.O.E., Building Research Station)	—
	(iii) synergistic effect of SO_2 in degrading of plastics	University of Aston, Aston Polymer Research School (under contract from D.O.E., Building Research Station)	—
	(iv) cleaning of stone and brick	Building Research Station, Bucknalls Lane, Garston, Watford WD2 7JR, Herts.	J. B. Dick (Director)
	(v) atmospheric pollution of natural stone	Building Research Station	—
	(vi) durability of concrete	Building Research Station	—
	(vii) degradation of surface coatings	Building Research Station	—
	(viii) weathering of plastics	Building Research Station	—
	(ix) screening of research chemicals (submitted by member pharmaceutical companies) for activity against fungi and marine algae; testing of active compounds in paints	Paint Research Station	—
	(x) study of factors affecting dirt pick-up and removal from paint films; optimisation of paint selection and cleaning	Paint Research Station (D.O.E. Research Contract)	—
	(xi) study of mechanical properties and chemical changes of paints produced by weathering: development of simple durability test	Paint Research Station (joint project sponsored by Ministry of Defence, Navy Dept.)	— —
	(xii) evaluation of priming systems for aggressive conditions of bridge undersides: laboratory tests and exposure trials	Paint Research Station (research contract for Transport and Road Research Laboratory)	—

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(xiii) evaluation of research chemicals for ability to give long-life protection of cement and concrete against terrestrial growth	Paint Research Station (research contract proposal)	—
	(xiv) effect of air pollution, weather, light, on degradation of titanium dioxide pigments in various media	British Titan Products Co. Ltd., Carlton Weathering Station	—
	(xv) Effects of air pollution on aluminium building fittings and methods of prevention	N.P.L.	—
	(b) Effect of air pollution on high voltage (25 kV) insulators	British Railways Board, Research Dept., Blandford House, Melbury Terrace, London N.W.1	The Director
	(c) Study of vertical distribution of air pollution at the Post Office Towers in London and Birmingham, in connection with effect on P.O. equipment	Post Office, Purchasing and Supply Dept., Materials Section, Fordrough Lane, Birmingham 9	R. J. Feasey
	(d) Effect of climate and air pollution on corrosion of steel	British Steel Corporation, Corporate Laboratories and Operating Divisions	
Part 5. **Measurement Methods** (See also specific programmes in Parts 1 to 4)			
	(a) Study of physical and chemical characteristics of pollutants and development of analytical techniques	M.R.C., Air Pollution Unit	—
	(b) Dust analysis	M.R.C., Pneumoconiosis Unit	—
	(c) SO_2 recorders; development of methods for making measurements from aircraft; automatic data logging and telemetering; fluorine measurement; international standardisation of methods	W.S.L.	—
	(d) Development of instruments and techniques for the examination and monitoring of atmospheric pollutants at iron and steelmaking plant	British Steel Corporation, Divisional Laboratories	—
	(e) Development of methods for identification and determination of gaseous and particulate pollutants	Ministry of Defence, Chemical Defence Establishment	—
	(f) Commissioning of a mobile air pollution laboratory containing infrared spectrophotometric, mass spectrometric and gas chromatographic analytical equipment for continuous or intermittent monitoring of the gaseous, and heavy metal particulate components of the atmosphere	Ministry of Defence, Chemical Defence Establishment	—
	(g) Use of low temperature crystal infra-red spectroscopy for measuring amines and sulphides	University of Salford, Dept. of Chemistry and Applied Chemistry, Salford M5 4WT	Professor W. J. Orville-Thomas
	(h) Development of simple, rapid methods for determination of toxic substances in industrial atmospheres	Laboratory of the Government Chemist, Stamford Street, London S.E.1	Dr. H. Egan

Problem	*Investigation*	*Organisation*	*Officer Responsible*
	(j) Development of X-ray fluorescence and polarographic methods for toxic metals in particulates, and specifition electrode methods for fluorides in factory emissions	Laboratory of the Government Chemist, Stamford Street, London S.E.1	—
	(k) Simple, rapid, sampling and analysis of unburnt hydrocarbon fuels in aero gas turbine combustion products using: (i) current gas/solid chromatographic techniques (ii) flame ionisation detector techniques	National Gas Turbine Establishment, Pyestock, Farnborough, Hants.	—
	(l) (i) Automatic continuous measurement of visibility by light scattering; automatic hourly filter tape equipment for collection of particulate matter, SO_2, ammonia and other pollutants	A.E.R.E.	—
	(ii) data logging equipment for measurement of meteorological parameters in association with the previous equipment; atmospheric stability indicator based on measurement of radon daughter products in the atmosphere	A.E.R.E.	—
	(iii) electron microscopy and diffraction for examination of atmospheric aerosols	A.E.R.E.	—
	(m) Flue dust monitor development	C.E.G.B.	—
	(n) Sampling and analysis of waste gases and particulate emissions from glass furnaces	British Glass Industry Research Association, Northumberland Road, Sheffield	Dr. R. G. Newton
	(o) Precise measurement of uv radiation, of possible application to detection of atmospheric contaminants	N.P.L.	—
	(p) Photometric analysis for sulphur oxides; chemiluminescence technique for NO_x; SF_6 tracer techniques for measuring pollutant dispersion	Esso	—
	(q) Analytical effort in support of research projects; data handling for automotive emission studies	B.P.	

Organisation	*Full name and address*	*Officer responsible*
A.E.R.E.	Atomic Energy Research Establishment, Health Physics and Medical Division, Harwell, Didcot, Berks.	N.G. Stewart
B.P.	British Petroleum Co., Britannic House, Moor Lane, London EC2Y 9BU Petroleum Division, Research Centre, Chertsey Road, Sunbury-on-Thames, Middlesex	—

Organisation	*Full name and address*	*Officer responsible*
	British Steel Corporation, Research and Development Dept., Head Office, P.O. Box 403, 33 Grosvenor Place, London S.W.1	—
	Burmah-Castrol Co., Burmah Refinery, P.O. Box 14, Bridges Road, Ellesmere Port, Wirral, Cheshire LG5 4ES	
C.E.G.B.	Central Electricity Generating Board, Research Dept., Courtenay House, 18 Warwick Lane, London EC4P 4EB	F. F. Ross (co-ordinator)
Esso	Esso Research Centre, Abingdon, Berks.	—
	Gas Council, 4/5 Grosvenor Place, London S.W.1	—
L.G.C.	Laboratory of the Government Chemist, Cornwall House, Stamford Street, London S.E.1	Dr. H. Egan
	London University: University College, Dept. of Geography, Gower Street, London W.C.1	Professor T. J. Chandler
Met. Office	Meteorological Office, London Road, Bracknell, Berks.	Dr. B. J. Mason (Director General)
	Ministry of Agriculture, Fisheries and Food, Agricultural Development and Advisory Service, Head Office: Great Westminster House, Horseferry Road, London S.W.1	—
	Ministry of Defence, Chemical Defence Establishment, Porton Down, Salisbury, Wilts.	G. N. Gadsby
	Microbiological Research Establishment, same address	C. E. G. Smith (Director)
M.I.R.A.	Motor Industry Research Association, Lindley, near Nuneaton, Warwicks.	—
M.R.C.	Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical School, Charterhouse Square, London E.C.1	Professor P. J. Lawther
	Pneumoconiosis Research Unit, Llandough Hospital, Penarth, Glamorgan, Wales	The Director
N.C.B.	National Coal Board, Head Office: Hobart House, Grosvenor Place, London S.W.1	—
	Coal Research Establishment, Stoke Orchard, Cheltenham, Glos.	Dr. J. Gibson (Director)
N.P.L.	National Physical Laboratory, Teddington, Middlesex	J. V. Dunworth (Director)
N.E.R.C.	Natural Environment Research Council, 27/33 Charing Cross Road, London W.C.2	—
Paint Research Station	Research Association of British Paint, Colour and Varnish Manufacturers, Paint Research Station, Waldegrave Road, Teddington, Middlesex	The Director
Shell	Shell Research Ltd., Central Laboratories, Whitehall Lane, Egham, Surrey	—
	Thornton Research Centre, P.O. Box 1, Chester	—
W.S.L.	Warren Spring Laboratory, Dept. of Trade and Industry, P.O. Box 20, Gunnels Wood Road, Stevenage, Herts. SG1 2BX	Dr. A. J. Robinson (Director)

The Warren Spring Laboratory of the Department of Trade and Industry

The two main areas of investigation by the Air Pollution Division at Warren Spring Laboratory are the measurement of air pollution and techniques for the control and reduction of air pollution levels. The programmes are mainly carried out in relation to the interests and responsibilities of the Department of the Environment and Local Authorities. Specific problems are tackled on a repayment basis for Local Authorities, industry etc. Other Divisions at WSL are increasingly involved with air pollution problems.

The National Survey of Air Pollution

For over a decade Warren Spring Laboratory has been responsible for the national surveillance of smoke and sulphur dioxide (and to a lesser extent grit and dust) on behalf of successive Government Departments administering clean air legislation. The Laboratory co-ordinates and standardises the voluntary efforts of Local Authorities and other bodies contributing to the National Survey and it centrally collates, disseminates and analyses the data produced.

There are now, summer 1973, 490 Authorities making daily smoke or SO_2 observations at 1212 sites. The survey is primarily of urban air pollution; only about 10% of the sites are in rural areas. In addition, monthly measurements of grit- and dust-fall are made with the British Standard Deposit Gauge by 177 Authorities at 572 sites. Monthly measurements are still made at 261 sites of the extent of reaction of sulphur compounds in the atmosphere with a standard lead dioxide surface. The Laboratory gives help and advice on all aspects of these co-operative investigations. In particular advice is given on the selection of sites.

The Annual Tables of air pollution measurements prepared by the Laboratory are available on request to all concerned with air pollution problems. For smoke and sulphur dioxide, these tables give, for each site and for each month of the year, the average concentration, the highest daily concentration and the number of days for which concentration exceeded certain values: 250, 500 $\mu g/m^3$ etc. The seasonal and annual average figures are also given. For grit- and dust-fall and for the lead dioxide observations the data for each month and the seasonal and annual averages are given.

A series of Reports has been prepared dealing with the National Survey of Air Pollution 1961-71. The four volumes of Reports covering the twelve statistical Regions of the United Kingdom are being published by HM Stationery Office, price £3·50 each. The Reports provide a critical breakdown of the data by size of conurbation, site type, season, etc, showing the general trends of improvement in air pollution but also highlighting those towns where concentrations are still undesirably high.

All Local Authorities and other organisations making measurements of air pollution which are published by Warren Spring Laboratory are entitled to send representatives to the Standing Conference of Co-operating Bodies organised by the Laboratory. Other bodies may do so on payment of a subscription. This Conference meets twice yearly to discuss relevant air pollution matters. At present 425 bodies have appointed representatives to the Conference.

Other Surveys

These cover, on a less than nationwide basis, surveys of emissions and ambient concentrations of industrial, vehicular and other pollutants. In the main the studies are for the Department of the Environment. Short studies are also commissioned on repayment by Local Authorities.

Roadside Pollution—Five Towns Survey

Following its reassuring 1960s survey of carbon monoxide levels for over a year in six cities, Warren Spring Laboratory has now embarked on monitoring a number of pollutants in the busiest streets of five towns in the United Kingdom—London, Cardiff, Glasgow, Cambridge and Birmingham—for a period of five years. Levels of carbon monoxide, total hydrocarbons, lead and smoke, together with traffic density and meteorological data are to be measured at all sites. In addition, at two sites in London, one at the roadside and the other a background station, nitric oxide, nitrogen dioxide, gaseous sulphur compounds and ozone are continuously measured. The data are reduced and analysed off line at WSL by computer.

As before the approach is to concentrate on situations in which the vehicle flow and street ventilation conditions are likely to lead to the highest levels of pollution. It will be possible to register trends in pollution levels produced by varying traffic load etc, or as a result of legislation on engine design, exhaust systems or fuel. The results will be of value to medical researchers, will contribute to the study of atmospheric chemistry and will be one of the basis for deciding on the possible need for further legislation.

Heavy Metals

1972 saw a study by various Government Departments, Local Authorities and industry of environmental health effects associated with some twenty scheduled lead works. Warren Spring Laboratory co-ordinated dust and soil sampling and analysis and made more detailed investigations within one works. Other processes dealing with lead have been the subject of Local Authority enquiries during 1973 and the Laboratory has advised on sampling and analysis. The Department of the Environment has commissioned the Laboratory to survey airborne metals in the vicinity of a number of metallurgical plants in the Birmingham area.

Pollution Abatement
Odours from Offensive Trades

During 1972 the Department of the Environment set up the Working Party on Odours from Offensive and Other Trades under the chairmanship of Dr Valentin, Deputy Director of Warren Spring Laboratory. The Working Party, which is to report in 1973 and 1974, is examining the major odour-producing industries, assessing the effectiveness of existing odour abatement techniques and looking, where necessary, for more successful practices. Warren Spring Laboratory is providing the Working Party with detailed technical support including several research projects.

Vehicle Pollution

One approach to the reduction of pollution of the environment by lead from petrol engined vehicles is to trap the particles of the metal within the exhaust system. WSL performed a preliminary study of such a device in 1971 and during 1973 has been taking part in a much larger DOE project to test these systems under a wide variety of conditions both on a number of road vehicles and on a static engine test rig. The Catalyst Section at WSL is investigating catalysts to improve exhaust gas composition.

Air Pollution Control through Planning

A WSL Working Party, including members from the fuel and energy industries and from the Alkali and Public Health Inspectorates, has been seeking to extend the existing Chimney Height memorandum to low sulphur fuels such as natural gas and to provide a realistic usable formula to take into account the effect of neighbouring buildings in deciding on recommendable chimney heights. This latter has proved a complex task but the Working Party aims to report to the Department of the Environment before the end of 1973.

Emission distributions in complex built-up areas are examined at WSL with the use of a wind tunnel. Studies include flats, offices and hospitals as well as industrial installations. For larger areas the Laboratory has been developing mathematical models to relate pollution levels and weather data to the detailed pattern of emissions. This allows the prediction of changes in pollution levels resulting from various potential developments and is an aid to planners. A major study of the Upper Forth Estuary is in hand for the Scottish Development Department.

International Transport of Air Pollutants

Scandinavian countries have been claiming that they are experiencing serious effects from the aerial importation of sulphur compounds. The UK is undertaking studies of the movement, transformation and fate of its sulphur dioxide emissions. WSL is contributing measurements of the flux of sulphur dioxide and its transformation products across the North Sea and is organising the UK contribution to a network of ground level measurements as part of an OECD study of the Long Range Transport of Air Pollution.

Measurement and Instrumentation

There is considerable international activity on the development and harmonisation of methods of measuring air pollutants and on the collection of air pollution data on an international scale. WSL is contributing to studies by WHO, OECD, ISO and EEC. Interest extends to the role of automatic monitoring systems with frequent data transmission to a central point for environmental control purposes.

The Central Electricity Generating Board

The main sources of air pollution from the operations of the Generating Board are the products of combustion of coal and oil. These are considered under the headings of: separation of solids from gases; dust measurement; disposal of solids; dispersion of gases.

Separation of Solids from Gases

Both the older and more modern pulverised fuel plants rely on electrostatic precipitation as the final or only stage of separation of particulate matter from flue gases. A research programme has revealed unexpected deficiencies in gas distribution, in rapping and in power supplies in some older plants. As soon as this research can be applied to individual plants, the deficiencies are being made good. Poor gas distribution leads to reduced efficiency because the greater efficiency of dust removal in a starved channel does not fully compensate for the reduced efficiency in an overloaded one; when, by means of velocity measurements and model techniques, the gas flow has been analysed, baffles can be designed and inserted to smooth the flow. Rapping impulses by means of which the collected dust is removed from the precipitator electrodes, have been found by actual measurement with accelerometers to be much attenuated if transferred from one member, such as a holding frame, to another, such as the plate or wire itself. Research on optimum electrical sub-division of the precipitator has shown the need for maintaining maximum power supply to each section and the importance of correct electrode spacing to reduce flashover.

Statistical analysis of the results of efficiency tests has shown the relative contribution to efficiency of such factors as size of precipitator, degree of sub-division, specific collecting area, power input, and the characteristics of the ash and the coal. It is clear that too low a sulphur content impairs collecting efficiency by making the particles electrically non-conducting, but no simple practical means of increasing the effective sulphur content of the ash from low-sulphur coals has been developed for routine application.

Dust Measurement

An important part of a dust-arresting installation is some means of informing the operator of any failure to function correctly. The pollution by dust at ground level is caused in the main by particles in the range from $20\mu m$ upwards, and an instrument has therefore been developed known as the CERL Dust Monitor which gives a continuous record of the emission of these coarser particles which are not recorded by instruments used to measure the emission of smoke. The CERL Dust Monitor has recently been redesigned.

The Mark II instrument is now commercially available, it has given a very reliable performance in Power Stations and is being tried out in other industries, including cement and iron works.

The nuisance from excessive emissions is a function of total output over a period of time, and integrators for the sum of the readings of all instruments in a power station over an eight-hour shift period are available.

The Mk. II instrument does not purport to deal with the very fine ash and black smoke particles which have a size less than 20 micrometers. These particles are, however, objectionable because of their appearance in the atmosphere. Smoke meters (sometimes referred to as opacimeters) are mainly influenced by the finest particles and provided they are designed with sufficient zero stability and sufficient sensitivity can give a valuable guide to the emission of fine dust and black smoke. An instrument which can be inserted from one side of a duct and removed for a manual check of zero has been developed, and is commercially available. An instrument with an automatic zero check has been developed and is under test.

Because it was thought that the standard deposit gauge had a limited application to modern dust problems, a new type of gauge has been developed for measuring dust in the field known as CERL Directional Dust Gauge. This has been used in routine measurements around a number of modern power stations and its directional characteristics are considered to be of considerable assistance in the interpretation of measured results. Its design has been modified to make it as cheap as possible to produce, and it is now covered by British Standard specification 1747 part 5 1972.

The conversion of smoke recording instrument reading to Ringelmann number has now been set out in an addendum to British Standard 2742 1969—addendum No. 1 1972.

Ash Disposal

Local air pollution can arise where dust which is handled or dumped is allowed to dry. Economical techniques of surface treatment are under investigation. There is a particular problem with cenospheres (floaters) on ash lagoons. These can dry on the surface layer and be picked up by the wind. A number of methods for dealing with this difficulty are now being investigated, from immobilising them *in situ* to harvesting them for industrial use.

Dispersion of Gases

Eight-port daily SO_2 samples are used routinely around power station sites for a number of years before and after commissioning of the stations. In addition a number of stations have been intensively instrumented using in each case about two dozen continuously recording SO_2 instruments and full meteorological instrumentation. The SO_2 recorders were developed about 10 years ago at CERL and have been successfully used in these surveys. The surveys have given excellent support to theoretical predictions and to the effectiveness of tall chimneys in controlling large-scale emissions of flue gas, as well as providing new knowledge on the particular influence of inversion layers above and below the chimney top. One important aspect of chimney height is now seen to lie in the proportion of inversions which are penetrated by the flue gases.

The Tilbury and West Burton investigations have been concluded. A further survey of this type is nearing completion at Eggborough which is the first 2000MW power station employing a single chimney. This survey has 25 SO_2 recorders and meteorological measurements which for the first time give details of atmospheric conditions up to 1,250 feet from the surface of the Earth. The use of a laser to measure the height of a plume, even though it is invisible to the eye, has been developed for some years at the Tilbury survey. This will continue to be used at Eggborough and its use will also be developed to study the temperature profile of the atmosphere in the range immediately above 1,250 feet. Observations of plume rise and ground level SO_2 concentration will also be made in due course at the Drax power station in Yorkshire, which has a single 850ft chimney designed for 4000MW of generating plant. Gas turbine plumes have also been studied.

Other Potential Problems

In recent years prominence has been given to claims by certain European countries that SO_2 emissions several hundred miles from their sources can adversely affect forests, agriculture and rivers by producing "acid rain". It has been widely acknowledged that insufficient scientific data are yet available to confirm or deny these claims and an international study of long-distance drift of SO_2 has been started under the auspices of OECD. The Generating Board is participating in the UK contribution to this work and in addition is making further studies of some relevant factors; such as the chemical reactions of SO_2 at low ambient concentrations and the rates of absorption of SO_2 at the surface of the earth. In a related field the extent to which low concentrations of atmospheric SO_2 may assist in meeting the essential sulphur requirements of growing plants is also under consideration.

The Atomic Energy Research Establishment

The Harwell atmospheric pollution programme is concerned with (a) the physical and chemical characteristics of pollutants and (b) pollutant life-cycles and reactions in the atmosphere. The principal areas of interest at present are the life cycle and long distance transport of sulphur compounds in the atmosphere, photochemical oxidants and their effects, nitrogen oxide chemistry, and lead aerosols in petrol engine exhaust. Two projects, one on the oxidation of sulphur dioxide in ambient air containing hydrocarbons and nitrogen oxides, and the other on the dry deposition of sulphur dioxide, form the UK contribution to the COST project.

Radiation fog is also studied in collaboration with the Meterological Office.

In addition, there is an environmental analysis project whose main objectives are: (a) to determine the atmospheric concentrations and origins of trace elements and their rates of deposition to vegetation and soil, (b) to survey heavy metal pollution in the Swansea area in association with medical, agricultural and botanical studies carried out by other laboratories, and (c) to assess the importance of atmospheric deposition of heavy metals to the sea.

In the field of radioactivity, measurements have been made since 1953 of fallout from nuclear test explosions in air and rainwater to give early indications of changes in the levels of fallout which affect levels of dietary contamination.

Work is in progress in which radioactive non-leachable monodisperse particles are administered to human volunteer subjects to measure the uptake and clearance of particles of various sizes from lung; to study the effects of different breathing patterns and the uptake, localisation and clearance of particles from the nose.

Studies are also carried out on the solubility of asbestos *in vivo* and the use of induced radioactivity to investigate the fate of inhaled and ingested asbestos fibres.

The progress of work on these topics is published in the annual report of the Health Physics and Medical Division.

Teesside Survey

The final report on the origins of industrial haze on Teesside has been published and was presented by the Under-Secretary of State, Department of the Environment, at a press conference in November 1972.

Life Cycle of Sulphur Compounds in the Atmosphere

Long range transport of sulphur dioxide and sulphates

It is claimed that rain in Scandinavia has become more acid in recent years because of sulphur compounds emitted in the UK and other countries of Western Europe and transported to Scandinavia.

The amount of sulphur dioxide emitted in the UK is known. To determine the amount transported to Scandinavia or other countries it is necessary to measure either (a) the amount redeposited in the UK, or (b) the flux of sulphur dioxide across the North Sea. The OECD Study on long-range transport of sulphur dioxide, in which other laboratories in the UK are taking part, attempts to answer these questions by measurement of sulphur deposited in rain and sulphur dioxide concentrations at ground level. In complementary Harwell investigations the dry deposition of sulphur dioxide (omitted in the OECD study) is being measured, and aircraft sampling is being used in conjunction with the Meteorological Office to determine the flux of sulphur dioxide across the North Sea.

Dry deposition of sulphur dioxide on vegetation is measured by the gradient method and by radioactive tracers. The first method is based on the fact that if a gas is absorbed at the ground surface there is an associated gradient of concentration with height. The flux of gas to the ground can be estimated if its concentration in air and also the wind speed are measured at two or more heights. Measurements are taking place over grassland, ploughed soil and over a forest canopy. In the second method sulphur dioxide labelled with radioactive sulphur-35 is released over natural grassland and its deposition velocity derived from measurements of the atmospheric concentration and the flux to the surface.

Sulphur dioxide oxidation mechanisms of atmospheric importance

Following laboratory measurements of the reaction kinetics, an important role is now assigned to ozone in promoting the oxidation of sulphur dioxide in the droplet phase. This may well provide the first satisfactory explanation of sulphur dioxide oxidation rates in cloud and fog droplets. In the homogeneous gas-phase oxidation of sulphur dioxide attention has now turned to the nucleation step in the conversion of sulphur dioxide to sulphuric acid droplets. Oxidation of sulphur dioxide under photochemical conditions in the presence of nitrogen oxides and unsaturated hydrocarbons has been shown to be of considerable importance in our laboratory studies and these are being extended to the atmosphere as part of the COST programme. In 1971 and again in 1972 a strong correlation was observed between the level of ozone produced on days with photochemical smog and the sulphuric acid concentration in the atmosphere.

Photochemical Smog

The ozone produced photochemically in the atmosphere by the Los Angeles type smog reaction from hydrocarbons and nitrogen oxides (emitted from vehicle exhausts and other sources) was measured at Harwell and near Ascot in 1972. The levels observed at both sites were similar to those measured by Warren Spring Laboratory in central London even though the nitrogen oxide concentrations differed by a factor of ten. This indicates that levels of ozone are not necessarily significantly greater in places where there are large local emissions of the precursor pollutants and reflects the time scale of a few hours necessary for the photochemical reaction to take place. A background station has been operated in 1973 on the west coast of Ireland to get well away from the widespread sources of pollution in the U.K.

Oxides of Nitrogen

The oxides of nitrogen (NO and NO_2) are important air pollutants which are emitted from both stationary and vehicular combustion sources, mainly as NO which is rapidly oxidised to NO_2 by atmospheric ozone. Mechanisms for the removal of nitrogen oxides from the atmosphere are poorly understood at present but considerable progress has been made in studying the conversion of NO_2 to nitric acid and thence to nitrate particles in the presence of ozone.

Lead

A large fraction of the lead in the atmosphere is derived from the use of tetraethyl lead in petrol. The lead is emitted from the exhaust systems of petrol engined vehicles as small particles, which can enter the body by inhalation or can deposit on crops which are consumed by grazing animals. A technique has been developed for the preparation of tetraethyl lead labelled with radio-active lead. This has been added to lead-free petrol and used in a petrol engine to produce exhaust containing particles labelled with radioactive lead. These particles are used in wind tunnel studies on deposition on grass and in inhalation studies with human volunteers. Electron microscope techniques are also used to try to identify the lead compounds present in the particles.

Fog Studies

Radiation fog is studied in collaboration with the Meteorological Office. Harwell measure visibility, liquid water content, fog drop size distribution and nucleus concentrations and also look for chemical changes, while the Meteorological Office team study energy and water vapour transfer rates, fog layer thickness and measures the relevant meteorological variables.

Trace Elements in Air and Rainwater

Trace elements in the atmosphere can be considered as (a) nutrients, (b) potentially toxic pollutants, and (c) as tracers of transfer mechanisms. The background levels of trace elements and the natural and unnatural variations about these levels are being measured to observe the passage of trace elements through the environment. Harwell carry out a national project to measure and interpret the levels of some 30 stable elements in rainfall and airborne dust at seven stations in non-urban areas. A similar but more intensive environmental programme is carried out at seven stations in the Swansea area. A third programme is carried out at two coastal stations and one on the North Sea.

Fallout

Rainwater is collected at eight stations in the UK and at 20 stations elsewhere from Tromso (70°N) in Norway to Halley Bay (76°S) in Antarctica. Airborne dust is sampled at ground level at five sites in the UK and at four sites overseas. The radioactivity in the samples is mainly measured by gamma-ray spectrometry and analysed by computer. These measurements provide an inventory of the radioactivity from nuclear tests explosions and give early indications of changes in the levels of fallout which affect levels of dietary contamination. The interpretation of the data also provides information relevant to the world wide transport of pollutants generally.

Inhalation Studies

The primary objective of this programme is the acquisition of basic information on the deposition of inhaled particles in, and the clearance of deposited material from the human respiratory tract. Systemic studies have been made of the effect of particle size and flow-rate on the deposition of radioactivity labelled spherical particles of unit density in the nasal passages of volunteers. The clearance of particles deposited on both the ciliated and non-ciliated regions of the nasal mucosa have also been studied. Rather similar techniques have been used to demonstrate impairment of nasal mucociliary clearance in woodworkers in the furniture industry. Currently, experiments are being carried out to study the effect of particle size and breathing pattern on deposition in the tracheobronchial and pulmonary regions of the human respiratory tract.

Asbestos

Work is in progress on the fate of inhaled asbestos particles of various sizes, shapes and chemical compositions in order to determine more precisely the quantities and sites of initial deposition, changes within the body and later retention. Inhalation experiments, using rats, have been carried out with most of the standard reference samples of asbestos which has been made radioactive. The radioactivity enables the initial pattern of deposition in the various regions of the respiratory and gastro-intestinal tracts to be determined. Autoradiographic technics enables individual fibres to be located in thin lung sections, and show the distribution of fibre in whole lung sections.

A study of the distribution of the trace metals, iron, chromium, cobalt, nickel and scandium in chrysotile asbestos shows that they can all replace magnesium in the brucity layer of chrysotile.

The Medical Research Council's Air Pollution Research Unit

The following notes describe briefly the current work on air pollution being done by the M.R.C. at St. Bartholomew's Hospital Medical College. For convenience the work is described in outline under various headings but it will be realised that the method of presentation does not mean that the topics are being investigated in isolation. The various investigations are highly integrated and it should be stressed that there is excellent liaison between the M.R.C. Air Pollution Unit, other M.R.C. units and outside bodies. The unit has been designated as the World Health Organisation International Reference Centre on Clinical and Epidemiology of Air Pollution.

Chemistry and Physics

As a prerequisite to the proper study of the effects of pollution much work is still being done on the chemical and physical nature of pollutants and methods for their determination.

Optical Assessment of Particulate Pollution

The changing nature of pollution in London now shows a lower proportion of black particulate matter. To study this development the oscillating cascade impactor was used to deposit size-selected, airborne particles on glass slides from which, by light scattering experiments it is possible to determine the ratio of black/white material.

The changing relationship between black pollution and concentration of pollution in terms of mass is being investigated using various filter media.

The efficiencies of several types of filter media have been determined with the collection of very fine airborne material in mind.

With the reduced amount of black pollution the measurement of reflectance from soiled filters has become more difficult. An extremely sensitive A.C. reflectometer has been constructed, which, when used with the specially developed sampling head readily gives reading of reflectance of the faintest stains. This instrument can be used to give readings for very low concentrations of some gaseous pollutants.

Studies on Carcinogens

Our interest in 3:4-benzpyrene and other polycyclic hydrocarbons is declining since not only are their concentrations in air now decreasing but the evidence that they are associated with lung cancer is much weaker than it was some years ago. Some studies on the stability of these hydrocarbons have shown that some of them appear to be destroyed by ultraviolet light and nitrogen dioxide. Investigation into the sources of polycyclics has shown that the relative proportion of certain hydrocarbons can vary; using a ratio of coronene to 1:2-benzpyrene (two stable hydrocarbons) it has been possible by analysing samples of collected smoke to identify sources of hydrocarbons such as coal fires and motor vehicles. A study into the production of hydrocarbons from burning fuels has shown that the above hydrocarbon ratio increases markedly as the combustion efficiency increases.

Asbestos

Asbestos can no longer be considered to be merely a pollutant of industrial atmospheres; recent work on the prevalence of mesotheliomas has shown the need to study it as an urban pollutant. Samples of asbestos which have been shown to be highly carcinogenic to rats have been examined for organic material.

Some preliminary studies on bulk samples of smoke collected in the City have been carried out in which the samples are extracted with organic solvents and ashed at low temperatures so that they can be examined with an electron microscope for asbestos fibres. A few asbestos-like fibres have been detected; examination using electron diffraction techniques has enabled us to identify this type of asbestos.

Acid Particles

Acid particles, which may be of clinical significance, are very common in town air. Their source at times of low pollution appears to be the efficient combustion of fuels; past records show that at times of high pollution synthesis of acid takes place and that high concentrations of sulphur dioxide and smoke occurring together are important for the formation of much particulate acid.

Carbon Monoxide

Because of the many sources of carbon monoxide, its varying concentrations in air, and the fact that its absorption depends on exercise and time, the measurement of carboxyhaemoglobin is greatly to be preferred to measurement of CO in air. The simpler indirect methods of measuring carboxyhaemoglobin such as the measurement of alveolar air are being tested; this involves simply analysing carbon monoxide in exhaled air after breath-holding.

Lead

Much work is being done on airborne lead from various sources. Trends in concentration, at different sites, of particulate and gaseous lead compounds are being assessed at various sites and their solubilities in various body fluids are being studied.

Electron Microscopy

Work is continuing on the depiction and identification of particulate pollutants by electron microscopy and electron diffraction, special attention being paid to asbestos and lead.

The site of deposition and degree of retention of particles in the respiratory tract depend on many factors among which are size and shape. Much work is being done on the electron microscopic appearance of particles in engine exhausts under different engine operational conditions and to relate these appearances to those particles found in streets and motorways. Special attention is being paid to the distribution of lead in particles with special reference to its biological availability.

Physics of the Lung and Measurement of its Function

The fundamental study of the lung as a physical system is enabling us to reassess the methods of measuring its function in health and disease. In the past, studies to determine the physiological effects of environmental pollutants have been hampered by the lack of a very sensitive test to assess the effects of respiratory insult, and as part of the search for a more refined technique, we are developing new methods of assessing respiratory function. The analysis of continuous respiratory waveforms is being studied using the unit's own on-line digital computer to process the physiological data.

The breathing signal is monitored with a simple strain gauge sensitive to changes in thoracic or abdominal circumference. Basic characteristics of each breath contained within a record of this signal are measured and the data are presented in graphical form on a visual display unit. The simple displays and mathematical transformations of them are used for comparing records of normal breathing obtained from human subjects before and after exposure to realistic concentrations of the common bronchospasm producing air pollutants. A model of this purely pneumatic aspect of the respiratory system is being developed.

Studies of Acute Effects of Inhalation of Pollutants

Very many combinations of gases and aerosols of different composition have been inhaled in order to study their effects on pulmonary function. Some of the healthy volunteer subjects have been shown to respond to realistic concentrations of sulphur dioxide in the laboratory, following forced respiratory manoeuvres.

At the beginning of a long series of daily measurements of airway resistance following exercise in the prevailing pollution in central London some correlation with pollution was found, and further results are being studied carefully.

Daily measurements of ventilatory function have been made for a five-year period on healthy volunteers, but no consistent relation with pollution has been found. However, there is some evidence of transient effects in periods of high pollution, particularly after exercise. From an extension of this study, a correlation has been found for one individual between the change in peak flow on entering London each morning and pollution. Some evidence of changes in peak flow in relation to pollution has also been obtained from long series of measurements on bronchitic patients.

Currently the effect on human subjects of gases and aerosols which may be found in the ambient air are being reassessed, using new tests of pulmonary function relating especially to possible changes in small airways.

Carbon Monoxide

Following the development of the micro-method for determining CO in blood (mentioned above), surveys of blood levels have been made in people exposed occupationally or experimentally to traffic. These have shown, so far, that levels above 4% saturation with carboxy-haemoglobin are rarely attained in non-smokers but levels higher than this (not uncommonly greater than 10%) are frequent in smokers. These surveys are being extended.

Experimental work is being done on the possible effects of carbon monoxide, producing a saturation of up to 10%, on the performance of fine tasks and on vigilance. So far, the results have shown no perceptible effects of such saturations on flicker and flutter fusion thresholds. These experiments have been extended so that the possible effects of 5% concentrated and diluted whole petrol and diesel exhausts on delicate lists of perception and performances could be examined. The effects have been demonstrated.

Pathology

We are perfecting a technique for assessing lungs received from operations or autopsies which will indicate the effects pollution has had on the large airways, the small airways, and the respiratory part of the lung, and the distribution of inhaled pigment. To simplify the gathering of a body of "normal" data against which to set polluted cases we are considering only non-smokers at present.

We are also studying the three dimensional anatomy of the respiratory part of the lung and that of lung tumours, together with the pollution history (domicile, occupation, respiratory diseases, smoking) of the patients from whom specimens have been removed surgically. The technical problems of preparing such lungs for quantitative assessment are also being tackled. The relevance of this fundamental work to the genesis of disease in relation to air pollution is obvious.

Bacteriology, Effects of Pollutants on Lung Flora

It has been suggested that pollution in town air is responsible for the greater prevalence of chronic bronchitis in towns compared with country districts. As part of our investigations into the possible relationship between air pollution and bronchitis we have been studying the effects (in vitro) of particulate pollutants collected from London air on the growth of some organisms found in the respiratory tract—Strep, viridans and Staph. aureus—and those commonly recovered from the sputum of patients with chronisc bronchitis—Strep. pneumoniac and H. influenzae.

Epidemiology

Trends in pollution in London are still being followed carefully: since the 1950's the average concentration of smoke has fallen by about 80%, and that of sulphur dioxide by about 50%, although there is now little further change from year-to-year. The most interesting feature as far as acute effects on health are concerned has been the virtual disappearance of episodes of high pollution, and by now it seems likely that this is a real change brought about at least partly by the removal of the "blanket" of smoke over London, that at one time prevented the sun from breaking up temperature inversions.

Now that there is no longer any clear evidence of sudden increases in hospital admissions or deaths in London in relation to pollution, more detailed studies are being undertaken in which these morbidity and mortality data are being analysed by cause and by age to see whether the effects of influenza epidemics, pollution, cold spells and other environmental factors either interact or are cumulative. Tabulations of daily deaths have now been obtained for other parts of the country, so that these studies can be extended to areas where the reduction in smoke concentrations has not been as great as in London.

The role of pollution as a contributory factor in the development of chronic bronchitis is being investigated in a number of ways. There are encouraging signs from the trends in bronchitis mortality that reductions in pollution may be having a beneficial effect, initially in London, but extending gradually to other urban areas. To separate effects of pollution from those of other relevant factors (notably smoking) it is however necessary to conduct special surveys. In one completed recently in London, early symptoms of respiratory disease among 18-year-olds were examined, comparing in particular a group born just before the fog of December 1952 with one born just after it. The results indicate that this single episode had no obviously dominant effect, but further studies are planned to assess whether continued exposure to high levels of pollution during childhood had adverse effects on the group as a whole. A longitudinal study of a group of medical students first seen at age 19 is being continued, and detailed pulmonary function studies are now being made on them for the third time. "Cross-sectional" studies of peak flow are also being made among office workers in the City of London, linking the results with smoking habits and area of residence.

Studies of lung cancer mortality now show that the rise in death rates among men is gradually drawing to a halt, whilst the rates for women are still increasing. The general trends are related to changes in smoking habits, but signs of a reduction in male death rates are appearing in London, sooner than in other parts of the country, and it is possible that reductions in pollution are playing some part in this.

The National Industrial Fuel Efficiency Service Ltd.

N.I.F.E.S. Ltd. provides a complete consulting engineering service covering all aspects of energy utilisation and associated pollution problems. Instrumented surveys are used to show by precise measurement how systems can be operated efficiently at minimum cost, and a regular service is provided to establish and maintain maximum efficiency. A full consulting service is provided for the design and specification of new plant and ancillary services and a comprehensive commissioning and testing service is also available.

Comprehensive advice and assistance are available in connection with the implementation of the Clean Air Act and with other types of problem, including noise abatement, water pollution and water conservation. Measurements of grit and dust emission as required by the Act can be undertaken. A complete design service is provided for Refuse Incineration.

Training courses for boiler operators and all personnel concerned with fuel and energy applications are arranged by request, and residential courses are also organised on oil and gas firing.

Process Development Associates

Process Development Associates was set up in 1971 to carry on the various testing services, including pollution, previously available from the British Coal Utilisation Research Association.

Enquiries should be addressed to The Sheet, Ludlow, Salop.

Section 4

Recent Books, Papers and Reports

A Selected List

All available on loan from the Society's library

Air Pollution and Lichens. Ferry, B. W., Braddeley, M. S., and Hawksworth, D. L. The Athlone Press of the University of London. (£6.25 net).

Air Pollution (2nd edn.). Faith, W. L., and Atkinson Jr., A. A. Pp 393. Wiley/Interscience, New York, London, Toronto, Sidney. 1972.

Air Quality Criteria & Guides for Sweden in regard to Sulphur Dioxide and Suspended Particulates. A report by an expert committee. Camner Per (editor). Stockholm. 1973.

Air Quality Criteria and Guides for Urban Air Pollutants. World Health Organisation. Technical Report Series No. 506. 1972.

Annual Report of the Scientific Adviser. Greater London Council. 1971. (£2.00).

108th Annual Report of Alkali &c. Works, 1971. Department of the Environment. Scottish Development Department, Welsh Office H.M.S.O. (£0.75 net).

Biological Indicators of Environmental Quality. A Bibliography of Abstracts. Thomas, W. A., Goldstein, G., Wilcox, W. H. Ann Arbor Science Publishers Inc. (£8.25).

The Biology of Pollution. Mellanby, K, Institute of Biology: Studies in Biology No. 38. Edward Arnold. 1972. (£1.50 hard cover, £0.75 soft cover).

Control Techniques for Asbestos Air Pollutants. U.S. Environmental Protection Agency.

Control Techniques for Beryllium Air Pollutants. U.S. Environmental Protection Agency.

Domestic Smoke Control in the North East. Clean Air Council. Report by a panel of the Council. 1972.

Environmental Education: a Source Book. Troost, C., and Altman, A. John Wiley & Son. 1973. (£5.50 cloth, £4.00 paper).

An Economic and Technical Appraisal of Air Pollution in the United Kingdom. Programmes Analysis Unit. H.M.S.O. 1972.

Indoor-Outdoor Air Pollution Relationships: a literature review. U.S. Environmental Protection Agency. 1972.

The Last Resource: Man's Exploitation of the Oceans. Loftas, Tony. Pelican. 1973.

The Law and Administration Relating to Protection of the Environment. Bigham, D. A. Oyez Publications. Pp 360. (£3.00).

Mercury and Air Pollution: a Bibliography with Abstracts. U.S. Environmental Protection Agency. October 1972.

National Survey of Air Pollution, 1961-1971, Volume Two. South West, Wales, North West. Warren Spring Laboratory. H.M.S.O.

National Survey of Air Pollution, 1961-1971, Volume Three. East Anglia, East Midlands, West Midlands. Warren Spring Laboratory. H.M.S.O.

Odours and Air Pollution: a Bibliography with Abstracts. U.S. Environmental Protection Agency. 1972.

Pollution: a Select Bibliography. Cuzner, G. D. Manchester Public Libraries. 1972.

Pollution in the Air. Problems, Policies and Priorities. Scorer, R. S. Routledge, and Kegan, Paul. 1973. £2.75 net).

Project Earth: An Action Guide for Young People. Searle, Graham. Wolfe Publishing. 1973.

Some Aspects of Plastics Waste Disposal. Interim Report of the Working Party on Designing for Disposability. The Plastics Institute.

The Social Consequences of Noise. Clarkson, B. L. Lecture to the Institute of Mechanical Engineers. February 1972.

Turbulent Diffusion in the Environment. Geophysics & Astrophysics Monographs. Csanady, G. T. D. Reidel. 1973.

Understanding and Controlling Air Pollution. Hesket, Howard E. Copyright 1972 by Ann Arbor Publishers Inc., U.S.A. Pp 411, 107 figures, 40 tables. (£7.75).

Urban Pressures on the Countryside. Committee for Environmental Conservation.

For further new publications see "Book Reviews" and "New Additions to the Library" in the Society's journal "Clean Air".

Films and Filmstrips

Following is a list of films and filmstrips on air pollution and its prevention, fuel efficiency, environmental protection, etc. Application for the loan of films should be made to the issuing organisation, referred to in the list by its initials, the key to which is given at the end of the list. The films are available free unless otherwise stated. Two - three weeks advanced notice of hire should be given. The running time in minutes is shown. Unless otherwise indicated, the films are available in both 16mm and 35mm sizes, with sound.

The Society welcomes information on other films suitable for inclusion in future editions of the Year Book.

Films

GENERAL AND EDUCATIONAL

The First Mile Up. The experience of cities in North America making vigorous efforts to combat air pollution. Smoke prevention in Toronto. Particularly well illustrated. 16mm. 28mins. C.F.C. (hire fee £1.60)

And on the Eighth Day . . . Outstanding programme on the pollution of our environment, in four sections: Water; Air; Earth and Fire. A serious and challenging film. (A Thames T.V. production) 60mins. Colour. C.F.C. (hire fee £6.60)

The Choice. The film's main themes are earth, fire and water. It concentrates on what is being done and what can be done, to preserve the environment. Science and technology have already provided most of the answers. Co-operation between industry and the community has already demonstrated that it can yield worthwhile results. Future success will depend on continuing investment, and above all a wider more vigorous co-operation. 29mins. Colour. I.C.I.

Environment in the Balance. The film shows how geological, topographical and social developments in Britain have helped shape our environment and discusses the problems of industrial expansion, population growth and pollution. Given the technological ability to safeguard the future, the issues depend on us all, as individuals. 16mm. 30mins. Colour. SM/BP (Hire fee 25p)

The Limits of Growth. The problems of our world point to disaster in the future. A group of influential academics and business men get together, with the help of a computer, to analyse the problems and find some solutions. It appears that all the issues (violence, pollution, starvation, population growth) are interlinked, and it would be of no use to attack just one aspect. Thames T.V. 1972. Colour. 60 mins. C.F.C. (hire fee £6.60)

A Breath of Spring. The film deals with the advantages of air conditioning. It investigates the effect of air on people—its effect on their comfort, convenience and concentration. It is not technical and although it starts off with some excellent shots of air pollution in our city streets, it is mainly intended for screening to owners and managers of shops and restaurants. It was made for the Air Conditioning Advisory Bureau, which is sponsored by the Electricity Council. 16 mm. 18 mins. Colour. E.C.

Conservation and Balance in Nature. A comprehensive picture of man's relationship to his environment, and the inter-relationship of the living things themselves. Examples of various environments and different kinds of living things are shown, and also the use of pesticides and chemicals, and the film ends by stressing man's responsibility to use wisely his natural environment. 18mins. Colour. C.F.C. (hire fee £1.10)

DOMESTIC AND SMOKE CONTROL AREAS

Clean Air. Deals with air pollution and shows how modern methods of domestic heating meet the requirements of the Clean Air Act. 16 mm. 21 mins. Colour. SM/BP (hire fee 25p) and C.F.L.

People Like Us. An amusing film in which three typical houses are taken apart at the seams, and set to rights with solid fuel heating throughout. 15 mins. Colour. N.C.B.

Home and Warm. Deals with the modernisation of an older type house and the installation of modern solid fuel central heating. 10 mins. Colour. N.C.B.

Welcome Home. Demonstrates the modern equipment available for burning solid smokeless fuels, and the range of these fuels available. The film also explains the Clean Air Act, how it works, and how solid fuel meets its requirements. 22 mins. Colour. N.C.B.

Group Heating in Paisley. District heating claims great advantages over the more conventional domestic heating particularly in new development areas as is shown in this study of how a large complex of flats in the Scottish town of Paisley is heated by solid fuel from a single central boiler plant. 7 mins. Colour. N.C.B.

District Heating in Leicester. Shows how new residential developments are supplied with heat and hot water from their own central boiler plant. 10 mins. N.C.B.

Billingham Group Heating Scheme. A solid fuel group heating scheme serving mixed industrial, commercial and residential premises in a new town extension at Billingham, Co. Durham. 14 mins. Colour. N.C.B.

Gas in Modern Housing. Stresses the need to incorporate clean air principles in new house design. It shows in some detail the flexibility and labour-saving advantages of gas for space heating, domestic hot water, incineration and other purposes. 16 mm. 18 mins. Colour. G.C.

Project Halton Fields. Features a typical modern housing estate to show new developments in domestic oil-fired central heating on a district level and indicates to developers and architects the advantages to them and to potential house-buyers of new systems and techniques. 16 mm. 20 mins. Colour. SM/BP (hire fee 25p)

HEALTH

It Takes Your Breath Away. A review of the causes of "dirty air" as produced by domestic and industrial smoke, traffic, etc. The effect on the lungs of living in this type of atmosphere is briefly shown and the film is of value to Public Health Workers as a means of ramming home the ill effects of a smoky atmosphere. 16 mm. 10 mins. B.M.A. (hire fee £1.25 plus VAT)

VEHICLE POLLUTION

City Limits. What are the factors that make a city a pleasant place to live and work in, with its own character and life? Jane Jacobs examines the trends that are killing cities now, particularly the private car, mainly in North America, but we have lessons to learn here before it is too late. 1972. Colour. 30 mins. (hire fee £4.00)

Horsepower and Hydrocarbons. The California Motor Vehicle Control Board explain the nature and extent of emission problems from the motor car. The alternatives to the petrol driven car are examined, as are methods of reducing levels of emission. The first film to approach all aspects of the problem fully. 16 mm. 22 mins. Colour. N.S.C.A.

FUEL, POWER AND INDUSTRIAL

No Tipping. Illustrates the "System Dusseldorf" approach to refuse disposal and shows the threat to clean air posed by traditional methods of refuse disposal. 16 mm. 14 mins. Colour. M.B.T.

Incineration—The Burning Question. Shows another method of refuse disposal and pinpoints the national problem of 17,000,000 tons of refuse needing to be disposed of annually. 30 mins. Colour. J.T.

Fluidised Coal Carbonisation and Hot Briquetting. There are not enough natural smokeless fuels. Coke is an excellent manufactured fuel but can be made only from certain coals. This film describes the work of the N.C.B. Coal Research Establishment at Stoke Orchard leading to the development of a new smokeless fuel for open fires. (For technically minded audiences) 12 mins. N.C.B.

Homefire—Smokeless Fuel for the Open Fire. Based on small-sized smoky coal, a new smokeless fuel has been developed by the N.C.B. which burns in an open grate and gives a good flame. The manufacture of these smokeless briquettes is explained non-technically. 12 mins. Colour. N.C.B.

Saharan Venture. The story of the transportation of methane gas from the Sahara to help provide Britain with abundant supplies of clean fuel. 16 mm. 28 mins. Colour. G.C.

The Methane Story. A longer version of the above film, made for the benefit of specialists. It gives a chronological account of the entire scheme, with emphasis on the methods and techniques employed. 16 mm. 28 mins. Colour. G.C.

Power in Trust. Electricity plays an important role in all our lives. Through the eyes of a schoolboy the generation of electricity in a modern power station is explained. 15 mins. Colour. M.R., C.E.G.B.

Combustion and the Chain Grate Stoker. Shows chemical and physical principles of coal, combustion, and their application in chain grate stoker. 16 mm. 25 mins. B. & W.

This Age of Steam. Emphasizes the growth of world population, rising industrialization and improving standards of living, which result in a rapidly increasing demand for power, chiefly electrical power. 16 mm. 35 mins. Colour. B. & W.

Industrial Electric Heating. Describes the use of electricity for industrial heating processes. 30 mins. Colour. E.C.

Combustion. An instructional film for service engineers and boilerhouse staff. Includes an introduction to elementary chemistry and the reason for the production of smoke. A simple way of measuring the carbon dioxide content and the method of carrying out a complete gas analysis with an Orsat apparatus is explained as well as how draught can be measured and controlled in an industrial boilerhouse. 16 mm. 31 mins. Colour. H. & B. (hire fee £3)

Pulverized Fuel. Deals with principles of pulverized fuel use. 16 mm. 40 mins. B. & W.

The Properties of Coal. Shows how the properties of coal vary according to the areas where it is mined, and how these characteristics affect its behaviour during combustion. The film gives an explanation of swelling number and shows how various types of coal suit different types of stokers. 16 mm. 20 mins. Colour. H. & B. (hire fee £3).

Sea Born Treasure. Vividly highlights the background to the discovery of the first major new indigenous source of power since coal; the progress made in bringing it ashore and the isolation and hardships endured by the crews of the drilling rigs. Touches upon the connection this discovery of gas in the North Sea and the effect its distribution may be expected to have on the national economy and the citizen. 16 mm. 25 min. Colour. G.C.

Air Flow. A research film showing a series of experiments with the Hydraulic Flow Model applied to the Chain Grate Stoker. The Flow Model is used to demonstrate the conventional method of supplying air to a Chain Grate Stoker with a Dual Zone System. 16 mm. 9 mins. H. & B. (hire fee £3).

Gas Flow. Research into the effects of various types of flue baffles and bridge heights in a Lancashire Boiler and an Economic Boiler. 16 mm. 7 mins. H. & B. (hire fee £3).

Synchromatic. Begins with a descriptive sequence of the hopper type Synchromatic Underfed Stoker. The second part deals with the bunker type stoker with the transfer box which can be set at any angle to the axis of the boiler and at any inclination to the ground. The final part of the film is devoted to the Stoker fitted to a boiler under fire. 16 mm. 12 mins. Colour. H. & B. (hire fee £3).

How Steam is Produced. Describes the production of steam in power stations using coal, oil, and nuclear fuel. Animation is used extensively to show the complete sequence of operations from the arrival of the fuel to the output of electricity. 18 mins. Colour. C.E.G.B.

How Electricity is Made. Describes the making of electricity for the nation's needs and its transmission in bulk to all parts of the country. Various fuels are used to make steam drive generators. The principles are illustrated in the film. 21 mins. Colour. C.E.G.B.

Electricity and the Environment. Pollution is one of the hazards of everyday life. The C.E.G.B. have their own pollution problems and this film shows, in general terms, the action taken to combat them. Colour. 22 mins. C.E.G.B.

The Air—My Enemy. The main theme of the film is contamination of the air, but other forms of pollution, which costs Britain £400 million a year, are described. The success achieved in eliminating smoke in London is outlined. But the film asks: "What about sulphur dioxide?" 1,200 measurements are taken throughout Britain every day, and we know that about six million tons of sulphur dioxide are pumped into the air every year. Research into better ways of using fuel is being carried out. One answer is natural gas, which produces no impurities. But the root cause of pollution is human greed. We must learn to control ourselves if we are to save our environment. 16 mm. 25 mins. G.C.

L'age de raison (English version). This film shows that the electricity supply industries of Europe are conscious of environmental problems, and actively contribute to the maintenance of the quality of life. At its point of use, electricity is a completely clean form of energy, while the problems which arise at the level of generation can be solved very satisfactorily, in particular with advent of nuclear power stations. This film is intended for general audiences, therefore a touch of humour has been introduced in certain sequences. Colour. 35 mm and 16 mm. 26 mins. C.E.G.B.

Key to Issuing Organizations:

B.M.A.—British Medical Association Film Library, Tavistock Square, London, W.C.1.

B.P.—B.P. Films, Britannia House, Moor Lane, London, EC2Y 9BU.

B. & W.—Babcock & Wilcox Ltd., Babcock House, 209 Euston Road, London, N.W.1.

C.E.G.B.—Central Electricity Generating Board, Film Library, Sudbury House, 15 Newgate Street, London, EC1A 7AU.

C.F.C. — Concord Films Council, Nacton, Ipswich, Suffolk.

E.C.—Electricity Council Marketing Department, Trafalgar Buildings, 1 Charing Cross, London, S.W.1.

G.C.—The British Gas Corporation, 16 Paxton Place, London, SE27 9SS. Phone 01-670 5786.

I.C.I.—I.C.I. Film Library, Thames House North, Millbank, London, S.W.1.

J.T.—John Thompson Ltd., Ettingshall, Wolverhampton, Staffs.

M.B.T. — Motherwell Bridge Tacol Ltd., Green Dragon House, 64-70 High Street, Croydon, Surrey.

M.R., C.E.G.B. — Public Relations, Midlands Region, C.E.G.B., Haslucks Green Road, Shirley, Solihull, Warwickshire.

N.C.B.—National Coal Board, Film Branch, Hobart House, Grosvenor Place, London S.W.1.

SM/BP — Shell-Mex and B.P. Film Library, 25 The Burroughs, Hendon, London, N.W.4.

FILM STRIPS

The following film strips are available on loan from the Society, except for the ones marked * which denotes for purchase only.

Air Pollution and You. Traces sources of air pollution and illustrates methods of control in 31 captioned frames. Colour, plus lecture notes. (Produced by Current Affairs Films of New York.)

Air Pollution. General survey of problems, methods of measurement, etc., prepared in consultation with the Association of Public Health Inspectors. Black and white, plus lecture notes. (Produced by Camera Talks Ltd.)

***Environment: Air Pollution, Parts 1 and 2.** (1) Local, Continental and Natural. 41 frames. (2) Industrial pollution. 38 frames. Colour, plus lecture notes by Professor R. S. Scorer. (Produced by Diana Wyllie Ltd.) Sale price £3 each part.

***Chronic Bronchitis.** Section 1: Incidence and Causes. Section 2: Treatment and Management. Section 3: Public Health and the Prevention of Chronic Bronchitis. Colour. Lecture notes by Dr. J. L. Burn. (Produced by Diana Wyllie Ltd.) Sale price £2.

Small Heating Systems. Colour. (Produced by Union Head Visual Aids Ltd. for N.I.F.E.S.)

The Problem of Lung Cancer. Colour. (Produced by Camera Talks Ltd.)

Making the Modern Town (Smoke Abatement). A lecture by the Gas Council. Black and white. (Produced by Carlton Hill Film Studios.)

The Public Health Inspector. Colour. (Produced by Camera Talks Ltd.)

***The Air You Breathe.** Colour, plus lecture notes by Rear-Admiral P. G. Ltd.) Sale price £3 full frame, £2.50 Sharp. (Produced by Diana Wyllie half frame. (Full frame suitable for mounting into slides.)

Guide to Publications

This list of available books, reports and pamphlets on smoke prevention, atmospheric pollution and fuel usage is issued by the National Society for Clean Air as a reference guide for readers. It may also be used for ordering the publications which may be obtained either direct from the Society, or other bookseller.

Prices quoted are those current at the date of publication, and are subject to variation. Please add the appropriate amount from the following table to all orders, for postage and packing. 50p and below add 7p. Between 51p and 99p add 15p. £1 and over add 25p.

Information about older, out-of-print, and overseas publications may be obtained from the Society on request. Most of these are in the Society's library and can be consulted, or in some cases borrowed for short periods, by arrangement.

The Society operates a photocopy service, for out of print literature, etc. The price is 7p per page.

N.S.C.A. PUBLICATIONS

General

"Clean Air"
The quarterly journal of the Society. It contains articles, photographs, reports, news items, abstracts and other current information appertaining to air pollution and allied matters. Subscription rate £1.50 per year post free. Single copies 50p.

"Sulphur Dioxide"
An examination of sulphur dioxide as an air pollutant.
Price: 50p

"Air Pollution from Road Vehicles"
Problems and control of air pollution from diesel and petrol motor vehicles.
Price: 20p

"The Law Relating to Air Pollution"
A Summary of Legislation.
Price: 15p

"Fumifugium" or "The Smoake of London Dissipated"
John Evelyn's well-known tract (1661).
Price: 25p

"Towards Cleaner Air"
Completely revised and updated.
Price: 50p

"Notes on the Background to Clean Air"
Very suitable for teachers, lecturers etc. complete with wall chart.
Price: 40p complete
25p Notes only
15p Wall chart

"Clean Air Act 1956"
A descriptive summary.
Price: 3p each, 10 for 25p

DES VOEUX MEMORIAL LECTURES

All at 5p each

"The Destructive Effects of Air Pollution on Materials"
Dr. A. Parker, 1955

"Meteorology and Air Pollution"
Sir Graham Sutton 1957

"Clean Air, Urban Amenity and the Growth of Towns"
Sir William Holford 1958

"Clean Air, Public Opinion and the Press"
Sir Linton Andrews

"Clean Air and Future Energy"
Dr. E. F. Schumacher 1967

CONFERENCE PROCEEDINGS

Details of earlier Conference Proceedings available on request.

Harrogate Conference, 1960. The Des Voeux Memorial Lecture — "Clean Air, Public Opinion and the Press," Address by Parliamentary Secretary, Ministry of Housing and Local Government, Series of progress reports on (1) Research and Investigation; (2) Domestic Heating; (3) Industrial Problems, Papers on Air Pollution from Road Vehicles, and an Inquiry into the Working of the Clean Air Act.
Price: £1.25

Brighton Conference, 1961. Opening Address by John C. George, Parliamentary Secretary, Ministry of Power, Presidential Address by Lord Cohen of Birkenhead. Reports on National Survey of Air Pollution. Furnace Operators Bill, Diesel Smoke; Papers on Industrial Aspects of the Clean Air Act, Whole House Heating, Smoke Control Areas and Transatlantic Discussion.
Price: 75p

Harrogate Conference, 1962. Five papers on air pollution in European Countries, a paper on the 1958 Alkali order Processes followed by a paper on Incineration and Waste Disposal.
Price: 25p (Preprints only)

Scarborough Conference, 1963. Address by The Rt. Hon. Lord Hastings, Papers on Smoke Control Areas and their Problems, The Importance of Public Relations, Air Pollution—The Human Problem, Pollution from Road Vehicles, Progress in a Heavy Chemical Industry, The Warwickshire Clean Air Council, Five papers on Research and Development and two papers on grit and dust emissions.
Out of print—photocopy service available.

Harrogate Conference, 1964. Opening Address by the Rt. Hon. Lord Sherfield. Presidential Address by Dr. Albert Parker. Smoke Control Area Reports from eight regions: two papers on Air Pollution and Town Planning, four papers on the future supply of smokeless Fuel; Des Voeux Memorial Lecture—"A Century of Achievement"; a paper on road vehicle pollution and discussion on the Sulphur Dioxide Report.
Price: £1.25

Eastbourne Conference, 1965. Opening Address by John Morris, M.P., Parliamentary Secretary, Ministry of Power, Presidential Address by Sir Alan Wilson, F.R.S. Three Reports on Successes with Smoke Control; two papers on solid fuel distribution and supply problem; air pollution and mortality; odour control; control of pollution from road vehicles; four papers on new horizons in domestic heating; two papers on industrial problems; two papers on unresolved problems in air pollution.
Price: £1.25

Blackpool Conference, 1967. Opening Address by Stephen Swingler, M.P., Ministry of State, Ministry of Transport, Presidential Address by Sir John Charrington. Report on Air Pollution from road vehicles: some specific air pollution problems; Clean Air and the North West Environment; two papers on effects of pollution on environment; Des Voeux Memorial lecture—"Clean Air and Future Energy"; a paper on the emission of grit and dust from furnaces; the cost of smoke control; a report on smokeless heating in new housing, industrial and municipal incineration of refuse; paper on new oxygen-fuel process in steelmaking.
Price: £1.00 (Preprints only)

Harrogate Conference, 1968. Part I: Four papers on Clean Air and Future Fuel Usage, three papers on Chimneys: Progress on Scheduled Works; three papers on the Measurement of Pollution; three papers on Vehicles; Paper on Practical Problems in the Approach to Smoke Control.
Out of print—photocopy service available.
Part II: Opening Address by Sir David Pitblado, K.C.B., C.V.O. Presidential Address by Sir John Charrington and Reports of Discussions.
Price: 75p

Eastbourne Conference, 1969. Part I: Paper on Outstanding Problems in the Heavy Clay and Refractories Industry; The Pottery Industry's Contribution to Clean Air; Air Pollution Control in Oil Refining; Paper on Sulphur Oxides and Fuel Oils, Clean Air and Health in London; Dust Control in the Cement Industry and two papers on Iron and Steel—Progress Towards Clean Air. (A) Review of Progress. (B) Some Practical Problems.
Out of print—photocopy service available.
Part II: Opening Address by Lord Delacourt-Smith, Presidential Address by Sir Kenneth Hutchison on behalf of Baroness Serota and Reports of Discussions.
Price: £1.00

Southport Conference, 1970. Part I: Two papers on the Clean Air Act 1968; Paper on The Disposal of Refuse by Incineration; three papers on Conservation; three papers on Clean Air—the Balance Sheet; four papers on the Fuel Industry's Viewpoint; and two papers on Vehicle Pollution.
Price: £2.00
Part II: Opening Address by Eldon Griffiths M.P. Presidential Address by Sir Kenneth Hutchison, Reports of Discussions, and the paper Conservation in the North-West.
Price: £1.25

Folkestone Conference, 1971. Part I: A report by the Society's Technical Committee on Sulphur Dioxide, two papers on Odours and their Control, three papers on the Meteorological aspects of Air Pollution, three papers on Aircraft Pollution and a paper on the National Survey—Trends in Pollution.
Price: £2.50
Part II: Opening address by Sir Eric Ashby, Presidential Address by Stanley E. Cohen, Reports of the Discussions.
Price: £1.50

Scarborough Conference, 1972.
Part I:
1. Pollution Control—How far can we go?
   Prof. C. J. Stairmand
2. Metals in the Atmosphere
   R. A. Fish
3. The Scheduled Processes
   F. E. Ireland
4. The Chemical Industry and Air Pollution
   F. Whiteley
5. Odour Nuisances in Industry
   T. R. Jones
6. Odour Nuisances in Agriculture
   Dr. F. H. Peakin
7. Effects of Air Pollution on Plants
   Dr. L. H. P. Jones and D. W. Cowling

Part II: Opening Address by Lord Kearton, Presidential Address by Stanley E. Cohen and Reports of Discussions. Price: 50p per paper or £5.00 complete set together with Part II.

Torquay Conference 1973.
Part I:
1. Smoke Control—A Stocktaking of the Present Position
   Mrs. A. Moss
2. Dartmoor Under Pressure
   Lady Sayer
3. The Invasion of the South West's Environment
   P. Turnbull
4. Control of Emission from Combustive and Non-Combustive Sources
   K. Darby and K. R. Parker
5. Living in Polluted Cities
   F. J. C. Amos
6. Pollution and Health
   Dr. R. Murray
7. The Effects of Some Air Pollutants on Farm Animals
   Dr. L. H. P. Jones and D. W. Cowling
8. The Effect of Pesticides on Life in the Soil
   J. Newman
9. Effects of Nitrates on Farm Animals
   A. H. Walters

Part II: Opening Address by D. Davies, Presidential Address by H. B. Greenborough, and Reports of Discussions
Price: 50p per paper or £5.00 complete set together with Part II

Technical Symposium, Manchester, 1972.
1. Industrial Waste—the Problem of Disposal
   N. Iliff
2. On site Incineration
   K. S. Dunn
3. Centralised Incineration
   W. A. Clennel and C. R. Mowle
4. Incineration of Rubber and Plastic Wastes
   G. Cheater
5. Incineration of Sewage Sludge
   G. Moodie
6. Integrated Environmental Design
   H. G. Mitchell
7. The Role of the Heating and Ventilating Engineer in Pollution Control
   F. M. H. Taylor
8. Dust Control in Factories
   P. Swift
9. Clean Rooms
   R. B. Williamson
10. A Practical Approach to the Statutory Control of Emissions
    C. R. Cresswell

11. Grit and Dust from Non-Combustive Processes
    C. D. Darley
12. High Efficiency Gas Cleaning
    K. Darby
13. Some Problems of Dry Processes for Removing SO_2 from Flue Gases
    J. Bettelheim and B. H. M. Billinge
14. Electrostatic Precipitators
    A. J. Moyes and M. Swift
15. Boiler Furnace Design Considerations for Dual Fuel Firing
    H. B. Weston
16. Modern Chimneys
    M. Beaumont
17. Progress in Automatic Control
    R. P. Braby

Part II: Report of the Discussions
Price: 50p per paper or £4.50 complete set together with Part II

Technical Symposium, Oxford 1973.

1. Lead in Petrol—is it Necessary?
   C. L. Goodacre
2. Acceptable Devices for the Control of Emissions
   Expert Panel
3. Why do Diesels Make Smoke—How May it be Abated?
   N. M. F. Vulliamy
4. Regulations Regarding Smoke Emission: Are They Adequate? How Can They be Strengthened?
   P. Draper
5. Control of Pollution in Jet Engines
   M. R. Williams
6. Gas Turbines for Rail Traction
   M. A. Stokes
7. The Future: The Alternative to the Motor Car—or Alternative Fuels
   Dr. C. G. Williams

Part II: Report of Discussions
Price: 50p per paper or £5.00 complete set together with Part II

INTERNATIONAL CONGRESS LONDON 1966

The following papers are available at 12p each:

Sources and Distribution of Air Pollution Ascertained by Stationary Recording of Gaseous Components. W. Breuer and K. Winkler.

Study of the Effect of Air Pollution Upon Respiratory Diseases in London in the Winters of 1962-63 and 1963-64. S. J. Carne.

Collection of Dust from Refuse Incinerators in Electrostatic Precipitators Provided with Multicyclone After-Collectors. C. Cederholm.

Atmospheric Pollution in Paris by Vehicle Exhaust Gases Measurement of Pollution Levels First Suggested Remedies. P. Chovin and R. Thiebault.

Alleviation of Air Pollution in the Coking Industry. R. L. Cooper and G. W. Lee.

Smoke and Sulphur Dioxide in Great Britain: Distribution and Changes. S. R. Craxford, Marjorie Clifton and Marie-Louise P. M. Weatherley.

Measurements of Concentrations of Particulate Pollutants in Ruhr. K. H. Friedrichs and A. Brockhaus.

The Working Party on Air Pollution—European Federation of Chemical Engineering. D. Gall.

The Concentration of Carbon Monoxide Measured at Different Altitudes Simultaneously in City Streets.
Sulphur Dioxide Concentrations Measured around a Modern Power Station.
E. W. F. Gillham, A. Martin and F. R. Barber.

Oil Burners for Domestic Application; Present Design and Future Developments. B. Gills and E. L. Howe.

Calculated Versus Continuously Measured SO_2 Concentrations with Regard to Minimum Stack Heights and Urban Renewal (urbanisme). K. Gräfe.

Tomorrow's Town Transport—The Advantages of Electric Traction. A. N. Irens.

Method for the Abatement of Air Pollution Caused by Cement Plants. W. Kohler.

Sub-Minute Continuous Nitrogen Dioxide Analysis. E. L. Kothny and P. K. Mueller.

Determinating Source Reduction Needed to Meet Air Quality Standards. Ralph I. Larsen.

Progress in Air Pollution Controls in South Africa. C. E. Latsky and E. C. Halliday.

Collection of Dust from Oil-Fired Boilers in Multi-Cyclones and Electrostatic Precipitators. S. Maartman.

Tree Belts as a Protection against the Harmattan in Nigeria. B. A. Molski.

Towards Cleaner Diesel Engine Exhausts. R. E. Pegg and A. W. Ramsden.

The Role of Gas in the Reduction of Air Pollution. F. F. Robb.

Air Pollution Monitoring in Canada. G. R. Ross and H. J. Wilson.

International Dust and Fume Collection Problems. G. G. Schneider.

Pioneering Experience with High Stacks on the Ovec and American Electric Power Systems. P. Sporn and T. T. Frankenburg.

Studies on Automatic Recording Apparatus for Measurements of Oxidants in Air. S. Suzuki.

OTHER PAPERS

1. **Some factors concerning Diesel Engine Exhaust Fumes.**
   J. K. Lock, 1960.
2. **Methods of Removing Smoke from Road Vehicles.**
   L. E. Reed and S. C. Wallin, 1960.
3. **Sampling for 3:4 Benzpyrene in Flue Gas from Plant fired by Petroleum Fuels.**
   E. L. Howe, 1960.
4. **Trends in the Pollution of the Air of Great Britain 1952-59.**
   J. Carroll, S. R. Craxford, H. E. Newall, P. M. Weatherley, 1960.
5. **Accuracy and Reliability of Instruments in Common Use for Measurement of Air Pollution.**
   S. R. Craxford, E. T. Wilkins, D. W. Slimming, 1960.
6. **The National Survey of Air Pollution.**
   Marjorie Clifton, S. R. Craxford, Mrs. P. M. Weatherley, 1961.
7. **Mitigation of Air Pollution at Coking Plants.**
   R. L. Cooper and J. P. Graham, 1962.
8. **Incineration and Waste Disposal.**
   S. Cayton, 1962.
9. **Power Stations and Clean Air.**
   G. N. Stone and A. J. Clarke, 1963.

10. **Odour Control by Catalytic Combustion.**
E. Betz, 1965.
11. **Corrosion by Air Pollution: A Review.**
J. R. Goss, 1967.
12. **Industrial and Municipal Incineration of Refuse.**
E. J. Ostle, 1967.
13. **Some Minerological Aspects of Air Pollution Damage to Limestone.**
K. J. Henley, 1967.
14. **The National Survey of Smoke and Sulphur Dioxide—The First Ten Years.**
S. R. Craxford, Mrs. P. M. Weatherley, Mrs. B. D. Gooriah, 1971.

Price: 10p per paper.

POSTERS

1. Prevent Air Pollution—Britain's Biggest Headache
2. Lungs, Plants, Animals, Buildings and Your Pocket are being attacked by Air Pollution
3. Couldn't You Do With Some Clean Air?
4. Road Vehicle Pollution

Price: 12p per poster (double crown)
£10 per 100 copies (can be mixed)

LEAFLETS

1. Clean Air Begins at Home
2. Prevent Air Pollution

Sample copies sent on request
Price: £5.00 per 1,000

A SELECTION OF BOOKS ETC. WHICH ARE AVAILABLE FROM THE SOCIETY

Books not listed may be ordered through the Society.

Air Pollution. Ed. Arthur C. Stern 1968. **Vol. 1: Air Pollution and its effects** pp. 850 £15.17. **Vol. 2: Analysis Monitoring and Surveying** £16.33. **Vol. 3: Sources of Air Pollution and their Control** £22.17.

Smoke Inspector's Handbook by A. Coe and I. M. Coe, 2 volumes. £7.50

Atmospheric Pollution: Its Origin and Prevention. Meetham, A. R., in collab. with Bottom, D. W. and Cayton, S. 3rd revised edition, pp. 301. Pergamon Press, Oxford. £3.50

Gas Purification for Air Pollution Control. Ed by G. Nonhebel, pp. 697, second revised edition. George Newnes, London. £12.50

Air Pollution. Smith, A. R. Monograph No. 22, Society of Chemical Industry, 14 Belgrave Square, London, S.W.1. 1966. £3·50

Clean Air—Law and Practice, Third Edition. Garner, J. P. and Crow, R. K., 1969, pp. 506. Shaw & Sons Ltd. £5·25

The Environmental Revolution. Nicholson, M., Hodder & Stoughton. £4·20

Air Pollution Control. Ed. Werner Strauss.
Part I £9.50 Part II £7.60

Ringlemann Smoke Chart (with instructional leaflet). Chart for measuring smoke density. 7p each: 10 for 60p

'Power's' Microringelmann. Direct facsimile reduction of the standard Ringlemann Chart (McGraw-Hill).
25p each: 10 for £2

H.M.S.O. PUBLICATIONS

Acts and Memoranda

Clean Air Act, 1956. The Statute governing smoke, containing sections on dark smoke, smoke from furnaces, grit and dust from furnaces, smoke control areas, smoke nuisances, special cases, clean air council and miscellaneous provisions. (H.M.S.O., 1956) 4 & 5 Eliz. 2 Ch. 52. 10p

Clean Air Act, 1956. Memorandum on Smoke Control Areas. (H.M.S.O., 1956) 6p

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions. (H.M.S.O., 1956) 3p

Amendment to Model Byelaws. Series IV Buildings (1953) Edition. (H.M.S.O., 1956) 1p

Thermal Insulation (Industrial Buildings) Act, 1957. (5 & 6 Eliz. 2 Ch. 40). (H.M.S.O., 1957) 3p

Clean Air Act, 1956. Memorandum on Industrial Provisions. (H.M.S.O., 1958) 5p

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions (Scotland). (H.M.S.O., 1959) 5p

Housing Act, 1964. (H.M.S.O.) 43p

Clean Air Act (Northern Ireland), 1964. Memorandum on Smoke Control Areas (H.M.S.O., 1965) 11p

West Riding County Council (General Powers) Act, 1964. (H.M.S.O.) 15p

Clean Air Act (Northern Ireland), 1964, Belfast. (H.M.S.O.) 17p

Chimney Heights. Second edition of the 1956 Clean Air Act Memorandum (H.M.S.O., 1967) 10p

Chimney Height Charts. The Appendices to the Clean Air Act publication "Chimney Heights" printed on permatrace. (H.M.S.O., 1967) 70p

Report of the Working Party on Grit and Dust Emission. (M.H.L.G. Memorandum). (H.M.S.O.) 15p

Clean Air Act, 1968. (H.M.S.O., 1968). Eliz. 2 Ch. 62. 10p

Statutory Instruments

The Clean Air Act 1956 (Appointed Day) Order 1956
(S.I. 1956, No. 2022) — 1p

The Smoke Control Areas (Authorised Fuels) Regulations 1956 (S.I. 1956, No. 2023) — 1p

Smoke Control Areas (Exempted Fireplaces) Order, 1957.
(S.I. 1957, No. 541) — 1p

Clean Air Council Order, 1957.
(S.I. 1957, No. 766)

The Clean Air Act 1956 (Appointed Day) Order 1958
(S.I. 1958, No. 167) — 1p

The Alkali etc. Works Order 1958
(S.I. 1958, No. 497) — 1p

The Dark Smoke (Permitted Periods) Regulations 1958
(S.I. 1958, No. 498) — 1p

The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (S.I. 1958, No. 878) — 1p

The Clean Air Act 1956 (Appointed Day No. 2) (Scotland) Order 1958 (S.I. 1958, No. 1931 (C.11) (S.104)) — 1p

The Alkali etc. Works (Scotland) Order 1958
(S.I. 1958, No. 1932 (S.105)) — 1p

The Dark Smoke (Permitted Periods) (Scotland) Regulations 1958 (S.I. 1958, No. 1933 (S.106)) — 1p

The Dark Smoke (Permitted Periods) (Vessels) (Scotland) Regulations 1958 (S.I. 1958, No. 1934 (S.107)) — 1p

The Smoke Control Areas (Exempted Fireplaces) Order 1959 (S.I. 1959, No. 1207) — 1p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1959 (S.I. 1959, No. 2264 (S.123)) — 1p

The Alkali etc. Works Order 1961
(S.I. 1961, No. 2261)

The Clean Air Council Order 1957 (Variation) 1962 (S.I. 1962, No. 128) — 1p

The Alkali etc. Works Order 1963 (S.I. 1963, No. 493)

The Smoke Control Areas (Authorised Fuels) Regulations 1963 (S.I. 1963, No. 1275) — 1p

The Smoke Control Areas (Authorised Fuels) (Scotland) Regulations 1963 (S.I. 1963, No. 1904 (S.103))

Buildings Regulations 1965 (S.I. 1965, No. 1373)

The Clean Air Act (Northern Ireland) 1964 (S.I. 1965, No. 72 (Northern Ireland))

Dark Smoke (Permitted Periods) (Northern Ireland) 1965 (S.I. 1965, No. 73 (Northern Ireland))

Dark Smoke (Permitted Periods) (Northern Ireland) (Vessels) 1965 (S.I. 1965, No. 74 (Northern Ireland)) — 1p

Smoke Control Areas (Authorised Fuels) (Northern Ireland) 1965 (S.I. 1965, No. 75 (Northern Ireland)) — 1p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1965 (S.I. 1965, No. 1284 (S.57)) — 1p

The Smoke Control Areas (Authorised Fuels) Regulations 1965 (S.I. 1965, No. 1508) — 1p

The Smoke Control Areas (Authorised Fuels) Regulations 1965 (S.I. 1965, No. 1951) — 1p

The Smoke Control Areas (Exempted Fireplaces) Order 1966 (S.I. 1966, No. 217) — 1p

The Smoke Control Areas (Authorised Fuels) (Scotland) Regulations 1966 (S.I. 1966, No. 714 (S.45)) — 2p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1966 (S.I. 1966, No. 715 (S.46))

The Alkali etc. Works Order 1966 (S.I. 1966, No. 1143) — 7p

The Motor Vehicle (Construction and Use) Regulations 1966 (S.I. 1966, No. 1288)

The Clean Air (Measurement of Grit and Dust) Regulations 1968 (S.I. 1968, No. 431) — 3p

The Clean Air Act 1968 (Commencement No. 1) Order 1968 (S.I. 1968, No. 1922 (c.27)) — 3p

The Clean Air Act 1968 (Commencement No. 1) (Scotland) Order 1968 (S.I. 1968, No. 1941 (c.28) (S.172))

The Smoke Control Areas (Exempted Fireplaces) Order 1969 (S.I. 1969, No. 164) — 3p

New Buildings—Prevention of Emission of Smoke (Northern Ireland) (S.I. 1969, No. 6) — 4p

The Clean Air (Height of Chimneys) (Exemption) Regulations 1969 (S.I. 1969, No. 411)

The Clean Air (Height of Chimneys) (Prescribed Form) Regulations 1969 (S.I. 1969, No. 412) — 5p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1969 (S.I. 1969, No. 686 (S.58))

The Clean Air Act 1968 (Commencement No. 2) 1969 (S.I. 1969, No. 995 (c.24))

The Clean Air Act 1968 (Commencement No. 2) (Scotland) Order 1969 (S.I. 1969, No. 1006 (c.25) (S.81)) — 2p

The Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (S.I. 1969, No. 1262) — 3p

The Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 (S.I. 1969, No. 1263) — 4p

The Clean Air (Arrestment Plant) (Exemption) (Scotland) Regulations 1969 (S.I. 1969, No. 1388 (S.108))

The Smoke Control Areas (Authorised Fuels) Regulations 1969 (S.I. 1969, No. 1798) — 2p

The Smoke Control Areas (Exempted Fireplaces) Order 1970 (S.I. 1970, No. 615) — 4p

The Smoke Control Areas (Authorised Fuels) Regulations 1970 (S.I. 1970, No. 807) — 3p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1970 (S.I. 1970, No. 1190 (S.97)) — 3p

The Smoke Control Areas (Authorised Fuels) Regulations 1970 (S.I. 1970, No. 1545) — 3p

The Smoke Control Areas (Exempted Fireplaces) (No. 2) Order 1970 (S.I. 1970, No. 1667) — 3p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1970 (S.I. 1970, No. 1762 (S.144)) — 3p

The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations 1971 (S.I. 1971, No. 161) — 5p

The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (S.I. 1971, No. 162) — 7½p

The Alkali etc. Works Order 1971 (S.I. 1971, No. 960) — 5p

The Smoke Control Areas (Authorised Fuels) Regulations 1971 (S.I. 1971, No. 1004)

The Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1971 (S.I. 1971, No. 1199) — 3p

The Smoke Control Areas (Exempted Fireplaces) Order 1971 (S.I. 1971, No. 1265) — 3p

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1971 (S.I. 1971, No. 1281 (S.164)) — 3p

The Smoke Control Areas (Authorised Fuels) (No. 3) Regulations 1971 (S.I. 1971, No. 1875) — 3p

The Smoke Control Areas (Authorised Fuels) (No. 4) Regulations 1971 (S.I. 1971, No. 2135) — 3p

The Smoke Control Areas (Exempted Fireplaces) Order 1972 (S.I. 1972, No. 438) — 3p

The Motor Vehicle (Construction and Use) (Amendment) Regulations 1972 (S.I. 1972, No. 805)

The Smoke Control Areas (Exempted Fireplaces) (No. 2) Order 1972 (S.I. 1972, No. 955)

The Gas Safety Regulations 1972 (S.I. 1972, No. 1178)

The Motor Vehicles (Construction and Use) (Amendment) (No. 5) Regulations 1972 (S.I. 1972, No. 1690) — 3p

The Motor Vehicles (Construction and Use) Regulations 1973 (S.I. 1973, No. 24)—73p

The Designation of Approval Marks (European Communities) Regulations 1973 (S.I. 1973, No. 1193) — 3p

The Motor Vehicle (Designation of Approval Marks) (No. 2) Regulations 1973 (S.I. 1973, No. 1194) — 5p

The Motor Vehicle (Type Approval) Regulations 1973 (S.I. 1973, No. 1199) — 21p

CIRCULARS

No. 27/57	Clean Air Act 1956 Smoke Control Areas (Exempted Fireplaces) Order 1957
No. 6/58	Clean Air Act 1956 Date of operation of remaining provisions; byelaws under section 24; miners' concessionary coal; approval of new furnaces.

No. 5/59	Clean Air Act 1956 Smoke Control Areas — 3p
No. 44/59	Smoke Control Areas (Exempted Fireplaces) Order 1959 — 1p
No. 28/60	Use of sticks and paper in smoke control areas — 4p
No. 1/61	Notification of provisional plans for establishing smoke control areas — 1p
No. 12/61	Clean Air — Air Pollution — Measurement and Research — 1p
No. 28/61	Selection of open fires for coke burning — 1p
No. 31/61	Works of adaptation eligible for Grant — 1p
No. 42/61	Industrial furnaces — 1p
No. 3/62	Smoke Control Areas
No. 4/62	Smoke Control in the Black Areas — 2p
No. 13/62	Homes for today and tomorrow — 1p
No. 50/62	i. Fuel Storage in New Local Authority Housing ii. Smoke Control Areas: Publicity Material — 1p
No. 60/62	Smoke Control Programmes 1962-66 — 1p
No. 7/63	Gas Cokes as open fire fuels — 3p
No. 69/63	Smoke Control Areas — 5p
No. 46/64	Housing Act 1964 Section 95: Amendment of the Clean Air Act 1956 — 2p
No. 60/64	Clean Air Act 1956: Housing Act 1964 — Designation of direct acting electric space-heaters — 1p
No. 13/65	Smoke Control Areas: Supplies of solid smokeless fuel — 4p
No. 51/65	Grant Arrangements — 4p
No. 69/65	Tall buildings and Industrial Emissions — 1p
No. 77/65	Smoke Control Areas: estimates and final costs — 4p
No. 18/66	Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1965 — 1p
No. 25/66	Clean Air Act 1956 i. Grant arrangements ii. Model Question and Answer Booklet iii. Exempted appliances — 5p
No. 42/66	Public expenditure — 3p
No. 25/67	Supplies of solid smokeless fuel — 3p
No. 52/67	Grit and Dust — 2p
No. 11/68	The Clean Air (Measurement of Grit and Dust) Regulations 1968 — 3p
No. 36/68	Clean Air Act 1956: Housing Act 1964 — Designation of direct acting electric space-heaters — 2p
No. 46/68	Clean Air Act 1956: Housing Act 1964 — Designation of direct acting electric space-heaters — 3p
No. 69/68	Clean Air Act 1968 — 9p
No. 2/69	Emissions from Cold Blast Cupolas at Iron Foundries
No. 28/69	(1) The Clean Air (Height of Chimneys) (Prescribed Form) Regulations 1969 (2) The Clean Air (Height of Chimneys) (Exemption) Regulations 1969 — 4p
No. 29/69	Exempted fireplaces — 2p
No. 54/69	Clean Air Act 1968 — 4p
No. 72/69	Clean Air Act 1968 (a) The Clean Air (Emissions of Dark Smoke) (Exemption) Regulations 1969 (b) The Clean Air (Arrestment Plant) (Exemption) Regulations 1969 — 6p
No. 97/69	The Smoke Control Areas (Authorised Fuels) Regulations 1969 — 2p
No. 4/70	Exempted fireplaces — 2p
No. 25/70	Exempted fireplaces — 2p
No. 42/70	The Smoke Control Areas (Authorised Fuels) Regulations 1970 — 2p
No. 63/70	Domestic Smoke Control — availability of solid smokeless fuel — 2p
No. 85/70	The Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1970
No. 2/71	Clean Air Acts 1956 and 1968 The Clean Air (Emission of grit and dust from furnaces) Regulations 1971; The Clean Air (Measurement of grit and dust from furnaces) Regulations 1971 — 3p
No. 12/71	The Smoke Control Areas (Authorised Fuels) Regulations 1971 — 2p
No. 32/71	Maximum Cost Limits — 3p
No. 35/71	Alkali etc. Works Regulation Act 1906: The Alkali etc. Works Order 1971 — 4p
No. 41/71	The Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1971 — 2p
No. 48/71	Exempted fireplaces — 2p
No. 53/71	Availability of solid smokeless fuel — 2p
No. 95/71	The Smoke Control Areas (Authorised Fuels) (No. 3) Regulations 1971 — 2p
No. 4/72	The Smoke Control Areas (Authorised Fuels) (No. 4) Regulations 1971 — 3p
No. 24/72	Exempted fireplaces — 2p
No. 6/73	Lead and the Environment — 5p
No. 53/73	Lead and the Environment — 5p

MISCELLANEOUS

Committee on Air Pollution.
The Interim Report of the Beaver Committee appointed in July, 1953, to examine the nature, causes and effects of air pollution and the efficiency of present preventive measures to consider what further preventive measures are practicable; and to make recommendations (Cmnd. 9011).
(H.M.S.O., 1953) 19p

Committee on Air Pollution.
The Final Report of the Beaver Committee. (Cmnd. 9322).
(H.M.S.O., 1954) 23p

The Investigation of Atmospheric Pollution.
Reports by the Fuel Research or Warren Spring Laboratory, Ministry of Technology co-ordinating local observations of atmospheric pollution 32nd Report (1958-1966) 52p

108th Annual Report on Alkali &c Works 1971 75p

National Survey of Air Pollution 1966-1971, Vol. I £3.50

Services Provided by the National Society for Clean Air

Information and Advice

General advice, assistance and information on matters relating to atmospheric pollution and its prevention is available free of charge to Members. If the information required is not immediately available to the Society's Information Department, the Society is prepared, on behalf of a Member, to obtain it from one of the specialised Information Bureaux.

Library

The Society's Library is available for the use of all Members, both for consultation in the Society's offices or for loan purposes. In most cases students or research workers can also use the facilities provided. It possesses an extensive collection of both British and foreign books, reports and pamphlets on air pollution and related subjects. In some cases the Society is the only organization in the United Kingdom receiving the publication. The Society is linked with various specialist and technical libraries, and when a publication relating to some special aspect of air pollution is not in the library, the Society can often borrow it through other sources. Applications should be made initially to the Librarian.

The library also possesses a classified collection of photographs (mainly black and white, some coloured) depicting domestic and industrial smoke; damage to buildings, stonework and plants and other allied subjects. These are suitable for reproduction and/or display purposes. Prints may be inspected at the Society's offices, or a selection will be sent by post if details of requirements are given. The copyright of the photograph is retained by the photographer and where reproduction fees are chargeable, the inquirer should communicate with the photographer. The Library does not hold any negatives.

A small collection of slides and film-strips are available for loan but two or three weeks' advance notice should be given for these. A comprehensive list of films available from other sources is given elsewhere in this Year Book.

Lectures

The Society will be pleased to help members and others in any part of the country to arrange lectures and talks of all kinds on atmospheric pollution and related subjects.

Exhibitions

The Society is prepared to consider participating in suitable exhibitions, and has a mobile modular exhibition stand available for this purpose.

Publicity Advisory Service

The Society's Publicity Advisory Service is available to help Local Authorities and Corporate Members with their Clean Air Publicity, especially when Smoke Control Orders are pending.

The Service advises members on display material, its arrangement for exhibitions, stands, etc., and supplies information on other publicity activities such as public meetings, local press features and correspondence, educational work in schools, women's organisations, etc.

No charge is made for this service to members.

Exhibition Display Material

The Society has several exhibition units available for loan by local authorities and corporate members. These units are adaptable for displays ranging from 20 sq. ft. to 300 sq. ft. of floor space, and are complete with their own graphics.

Demand for these units is heavy particularly in the spring and autumn, and it is essential that inquiries are made as far in advance as possible.

No charge is made to members for the loan of these units except the cost of carriage both ways. A hire charge of £10 is made to non-members together with carriage both ways.

Posters and Leaflets

Details and prices of suitable posters and leaflets can be found elsewhere in the Year Book.

41st CLEAN AIR CONFERENCE

CARDIFF

14th—18th October, 1974

Further details from:
National Society for Clean Air,
136 North Street,
Brighton BNI IRG
Telephone: Brighton 26313

The Clean Air Case

A Synopsis for the Guidance of Speakers, Writers, Teachers, etc.

1. Historical Background. Growth of the air pollution problem and efforts to abate it, from 852 to the present day. (*See History table.*)

2. Nature, Sources and Causes.
Smoke: Due to incomplete combustion; consists of fine carbonaceous particles and tarry droplets. (For quantities produced, *see Table.*)

Gases: Sulphur dioxide the most harmful, especially when in association with smoke particles. Also carbon monoxide, and noxious gases and fumes from chemical processes. See the Society's Report on *Sulphur Dioxide as an Air Pollutant.*

Grit and dust: Mainly from industrial sources, e.g., pulverized coal and highdraught furnaces.

3. Extent and Behaviour of Pollution. Measurement of floating and deposited impurities, sulphur dioxide, and of light values. The Investigation under the Warren Spring Laboratory (*q.v.*).

4. Fog. Natural and smoke fogs, their formation and characteristics. The London, 1952, 1962, and other lethal smogs.

5. Effects. *Health*: Effects on respiratory system. Effects due to obstruction of natural light. Possible relationship with lung cancer. Psychological and social consequences of life in smoke-ridden environment. Effects of smog are the result of infrequent high concentration of pollution, whereas the insidious action of "normal" pollution takes place continuously.

Plant Life: Principal factors injurious to vegetation are: loss of sunlight, blocking of stomata by deposits, direct attack by chemicals, acidification of soil. Indirect effect on grazing animals through deterioration of herbage, or of poisoning in the case of fluoride pollution.

Materials: Corrosion or erosion of metals, stone, fabrics, leather, etc.

Visibility: Loss of visibility due to smoke haze and smog affecting air and surface transport.

Costs: *See table.*

6. Prevention. *Industrial Smoke*: Calls for correct equipment, maintenance and operation of plant. Value of mechanical stoking. Uses of oil, gas, electricity and smokeless solid fuel. Importance of training and certification of stokers. Instrumentation, smoke alarms, etc. Need for all-round fuel efficiency. *Dust and grit*: Use of arrestors of appropriate types: cyclones, wet washing, electrostatic precipitators. *Sulphur*: removal by coal washing, flue gas-washing and other possible means. Importance of high chimneys and emission velocity.

Domestic: By use of smokeless fuels—gas, electricity, oil or solid. Need for efficient appliances. Central and district heating, whole-house warming, off-peak electrical methods, etc. Smoke control areas, purpose and national programme.

Railways and Roads: Use of diesels and electricity for the former. Need for efficient combustion and good maintenance in road vehicles. (*See also N.S.C.A. booklet "Air Pollution from Road Vehicles".*)

7. Policy, Law, etc. The present law—Clean Air Acts, 1956 and 1968, Public Health Act, 1936, local Acts, Road Traffic Act, 1930, Alkali, etc., Works Regulation Act, 1906, and Orders, etc. The Beaver Report and its proposals. Responsibilities of local authorities and central Government. Smokeless zones and smoke control areas. Work of the Warren Spring Laboratory. Alkali Inspectorate and other organizations. Educational and publicity work of the National Society for Clean Air.

(See also the N.S.C.A. booklets "Notes on the background to Clean Air", and "Towards Cleaner Air".

Section 5

DIRECTORY OF CONSULTANTS

J. E. Arregger & Co.
16a King Street, Twickenham,
Middlesex TW1 3SN
tel: 01-891 1242

A group of professionally qualified engineers offering a design and consulting service to the Petroleum and Process Industries. In addition to chemical and mechanical engineering, design of major electrical and civil projects may be undertaken through this association.

* **W. S. Atkins & Partners**
Woodcote Grove, Ashley Road,
Epsom, Surrey
tel: Epsom 26140

Considerable experience in the prevention of atmospheric pollution from existing manufacturing plants or projected new ones. Experience includes the control of air pollution from steelworks, power stations and incineration plants, as well as pollution surveys for recreational areas.

D. Balfour and Sons
Yeoman House, 63 Croydon Road,
London SE20 7TW
tel: 01-659 2221

Bostock, Hill and Rigby Ltd.
37-39 Birchfield Road,
Birmingham B19 1SU
tel: 021-554 2284

A. Cluer, B.Sc., F.R.I.C., F.I.Chem.E., F.Inst.Pet.
"Middlemarch", Oast Road, Oxted,
Surrey RH8 9DX
tel: Oxted 3077

Consultant to Burmah Oil Co., Ex Director Group Refineries Department. Technological advice in all fields of petroleum refining, including associated environmental problems.

Brian Colquhoun and Partners
18 Upper Grosvenor Street, London
W1X 0AP
tel: 01-629 9636

Projects handled in connection with prevention of air pollution apply to power stations, hospitals, chemical industries, hotels, passenger buildings of airports.

* **British Consultants Bureau**
55-58 Pall Mall, London SW1Y 5LH
tel: 01-839 7687

Dr. S. R. Craxford, I.S.O.
24 Field Lane, Letchworth, Herts
SG6 3LE
tel: 04626 5085

Cremer and Warner
140 Buckingham Palace Road
London SW1W 9SQ
tel: 01-730 0777
telex: 918666 (Creconsult LDN)

Air quality advice to industry and control authorities in the U.K. and overseas, feasibility studies, technical audits, monitoring surveys, project planning and engineering services.

* **Depeco**
Via Farini 10, 40124 Bologna, Italy

Dr. I. G. C. Dryden, Ph.D., D.Sc., C.Eng., F.R.I.C., F.I.Chem.E., F.Inst.F.
112 Sandy Lane South,
Wallington, Surrey SM6 9RG

Fuel technology (coal).

* **Eco-Plan**
Barclays Chambers, Market Place,
Durham City, DH1 3NB
tel: 0385 5555

Environmental Resources Ltd.
49 Rivington Street, London
EC2A 3QB
tel: 01-739 0541/7927

Environmental Resources is an independent multi-disciplinary science-based consultancy which identifies environmental and pollution problems and advises on remedial action. It offers an integrated service to industry and government by utilising the skills and practical experience of a team of scientists, technologists, economists, architects and engineers.

Charles Forrester, B.Sc., Ph.D., F.R.S.E., F.R.I.C., A.M.I.Chem.E., F.Inst.F., F.H.-W.C.
1 Hampton Grove, Ewell
Epsom, Surrey
tel: 01-393 1004

Fuel technology, mineral chemistry, utilisation of minerals, forensic science, technical and scientific editing.

Douglas G. Furzey, B.Sc., C.Eng., F.R.I.C., F.I.Chem.E.
Barn Hey, 6 Dinorben Avenue,
Fleet, Hants GU13 9SG
tel: Fleet (02-514) 5653

Economic and technical studies and designs for the process industries including waste and effluent disposal, solvent recovery, furnaces and combustion processes, heating, ventilating, air conditioning, fume control and clean atmospheres.

Gaffney, Cline & Associates Ltd.
GCA International Building,
Rosemount Avenue, West Byfleet,
Surrey
tel: Byfleet 49393

Process Design and Evaluation of all air pollution control installations with special reference to liquid fuels. Considerable engineering experience available for subsurface disposal of wastes.

R. W. Gregory & Partners
Concord House, Feltham, Middlesex
tel: 01-890 1181
also Birmingham, Cardiff, Glasgow,
Liverpool, Manchester,
Newcastle upon Tyne

Mechanical and electrical consulting engineers, specialising in environmental control, heating, lighting and power supplies, commercial and industrial boiler plant and distribution systems. Consultants to Regional Hospital Boards, Universities, Local Authorities and Industry throughout the U.K.

*** John H. Hastie & Partners**
Belmont House, 20 Wood Lane,
Leeds LS6 2AG

Specialists in pollution control who have been consulted on air pollution problems in respect of various industrial complexes and municipal incineration installations in the U.K., Spain, Italy and Belgium.

P. G. W. Hawksley Process Development Associates
The Sheet, Ludlow, Salop
tel: Ludlow 3888

H. Hayhurst, M.Sc., C.Eng., F.R.I.C., A.M.I.Chem.E., M.R.S.H.
"Fouray", Parkfield Road South,
Didsbury, Manchester M20 0DA
tel: 061-445 3224

Infestation of stored products, industrial weedkilling and pest control.

Kennedy & Donkin
Premier House, Woking, Surrey
GU21 1DG
tel: 04862-5900

Designs of thermal power stations, refuse incineration plants, industrial and commercial undertakings involving environmental engineering of total energy and district heating projects have given Kennedy & Donkin wide experience in pollution control.

Marks, Dawes & Associates
1304 Sanlam Centre, P.O. Box 112,
Cape Town, South Africa.

Consulting Chemical Engineers particularly active in the field of waste and effluent treatment, environmental engineering and corrosion.

V. C. Marshall
University of Bradford, Schools of
Chemical Engineering, Bradford,
Yorkshire BD7 1DP
tel: Bradford 33466

Postgraduate School of Studies in Powder Technology, University of Bradford. Chairman: Dr. J. C. Williams. Concerned, inter alia, with particle fluid interactions and design principles of apparatus for the separation of particles from gases.

*** Merz and McLellan**
Amberley, Killingworth, Newcastle
upon Tyne, NE12 0RS
tel: Newcastle 663955

D. V. Mitchell, C.Eng., M.I.Chem.E.
"Whitewebbs", Woodland Avenue,
Cranleigh, Surrey
tel: Cranleigh 2411

Main activities concerned with handling and processing of solids and dealing with subsequent exhaust emissions, particularly in the scrap metal recovery and animal waste product processing fields including destruction of offensive odours.

Dr. G. Nonhebel
57 Woodley Lane, Romsey SO5 8JR
tel: 0794-513408

Chemical Engineer and Fuel Technologist.

*** Norris Consultants Ltd.**
Europa House, Queen's Road, Bristol
BS8 1AU
tel: 0272 36817

Advisors in industry, public authorities and others in U.K. and overseas on control of pollution from boilers, chemical plant, dust producing plant, including full consultancy service.

Dr. A. Parker, C.B.E.
5 Wellesley Avenue, Northwood,
Middlesex
tel: Northwood 26435

Parsons Brown
Astronaut House, Hounslow Road,
Feltham, Middlesex
tel: 01-890 0842

Civil, structural, mechanical and electrical consulting engineers, undertaking the investigation of pollution, recommendations for its control, design of projects, preparation of specifications and supervision of construction works. Offices in London, Bristol, Birmingham, Portsmouth and Beirut.

Derek B. Purchas, B.Sc., Dip.Chem.Eng., C. Eng., F.I.Chem.E.
"Holmcroft", Heathside Park Road,
Woking, Surrey
tel: Woking 62885

Chemical engineering advice; filtration and separation technology; distillation; effluent treatment; odour control; solvent recovery. Feasibility studies; investigations; design; engineering services; expert evidence; market surveys.

Professor C. J. Stairmand, O.B.E.
66 Emerson Avenue, Middlesbrough,
Teesside TS5 7QQ

Consultancy service in environmental studies, pollution control, equipment design and assessment.

Sumner and Partners
251 High Street, Orpington,
Kent BR6 0PH
tel: Orpington 36911

Sumner Europe Soc. Civ.
16 Avenue de la Renaissance,
1040 Brussels
tel: Brussels 36.00.80

A multi-disciplined consultancy, which provides for all aspects of pollution and public health with special reference to environmental problems connected with toxic and non-toxic emissions to the atmosphere and control of effluents to land and sea, and maintains continuous liaison with international developments.

* *Entry taken from last issue of "Clean Air Year Book" as no reply received from enquiry.*

The International Union of Air Pollution Prevention Associations

The International Union was originally established in 1965 with six founder members—United States of America, Argentina, France, Great Britain, Japan and West Germany. The Union consists of non-governmental organisations only and its primary functions are to promote collaboration and the exchange of information on air pollution and environmental problems and to organise, through its member associations, international congresses.

The first congress of the Union was held in London in 1966; the second International Clean Air Congress was held in Washington D.C., U.S.A. from 6th December to 11th December 1970 and the third International Congress was held in Dusseldorf, Federal Republic of Germany, from 8th to 12th October 1973. The 4th Congress will be held in Japan during mid-May 1977.

The President of the I.U.A.P.P.A., the fourth one to hold office, is Professor Dr. H. Schackmann of V.D.I.—Kommission Reinhaltung der Luft, of the Federal Republic of Germany; the Secretary of the International Union is Dipl. Ing. N. Endell.

Since its inception in 1965 the I.U.A.P.P.A. has now grown to twelve full corporate members and six affiliate members.

Corporate Members:

Asociacion Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires, Argentina.

Clean Air Society of Australia and New Zealand, P.O. Box 59, Bankstown, 2200 Sydney, New South Wales, Australia.

Associação Brasileira de Prevenção à Poluicão do Ar, Departamento de Saúde Ambiental, Faculdade de Saúde Publica, Caixa Postal 8099, Sáo Paulo, Brazil.

Association Pour La Prévention de la Pollution Atmosphérique, 62 Rue de Courcelles, Paris 8e, France.

VDI-Kommission Reinhaltung der Luft, Graf-Recke Strasse 84, Postfach 1139, 4 Dusseldorf 1, Federal Republic of Germany.

National Society for Clean Air, 134-137 North Street, Brighton BN1 1RG, Great Britain.

National Association for Clean Air, P.O. Box 5777, Johannesburg, Transvaal, South Africa.

Japanese Union of Air Pollution Prevention Associations, 54 Takata-Oimatsu-cho, Bunkyo-ku, Tokyo, Japan.

Asociacion Mexicana Contra la Contaminacion del Agua y del Aire, A.C., Toree de Ciencias 5° Piso, Ciudad Universitaria, México 20, D.F., México.

SICOM, Stichting International Contactorgaan Milieubescherming, Postbus 214, Delft, The Netherlands.

Schweiz. Vereinigung für Gesundheitstechnik (SVG), Postfach 305, 8035 Zurich, Switzerland.

Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pa., 15213, U.S.A.

Associazione Termotecnica Italiana, Piazzale R. Morandi, 2 20121 Milano, Italy.

Affiliate Members:

Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.), Den Norske Ingeniørforening, Kronprinsensgate 17, Oslo 2, Norway.

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire, Jr, Moquegua 336 - Of. 206, Lima, Peru.

Asociacion Uruguaya Contra la Contaminacion del Aires, Calle Colonia 1422, P.6, Ap. 601, Montevideo, Uruguay.

Yugoslav Commity for Chemical Engineering, Section of Air Pollution Prevention, Sarajevo, Omladinsko setaliste bb, Yugoslavia.

The Public Council for the Prevention of Noise and Air Pollution in Israel, P.O.B. 23047, Tel-Aviv, Israel.

Associated Organisation

New Zealand Clean Air Society Inc., P.O. Box 2365, Christchurch, New Zealand.

DIRECTORY OF ORGANIZATIONS

with Air Pollution Interests

GREAT BRITAIN

ARTS, ARCHITECTURE AND TOWN PLANNING

Building Centre, The, 26 Store Street, London WC1E 7BT. (01-637 1022: Administration) (01-637 4522: Information).

Building Research Establishment, Building Research Station, Garston, Watford WD2 7JR. (Garston (Herts) 74040). Fire Research Station, Borehamwood, Herts WD6 BL. (01-953 6177). Princes Risborough Laboratory, Princes Risborough, Aylesbury, Bucks. (Princes Risborough 3101).

Civic Trust, 17 Carlton House Terrace, London SW1Y 5AW (01-930 0914).

Housing Centre Trust, 13 Suffolk Street, London SW1Y 4HG (01-930 2881).

Incorporated Association of Architects and Surveyors, 29 Belgrave Square, London SW1X 8QF (01-235 3755/7).

Institution of Civil Engineers, Great George Street, London SW1P 3AA (01-839 3611).

Institute of Housing Managers, Victoria House, Southampton Row, London WC1B 4EB. (01-242 3267/8).

Institution of Municipal Engineers, 25 Eccleston Square, London SW1V 1NX. (01-834 5082/3).

International Institute for Conservation of Historic & Artistic Works, 608 Grand Buildings, Trafalgar Square, London WC2N 5HN. (01-839 5975).

National Housing and Town Planning Council Incorporated, 11 Green Street, London W1Y 4ES. (01-629 7107/8).

Royal Institute of British Architects, 66 Portland Place, London W1N 4AD. (01-580 5533).

Royal Society of Arts, 6-8 John Adam Street, London WC2N 6EZ. (01-839 2366).

Royal Town Planning Institute, 26 Portland Place, London W1N 4BE. (01-636 9107/8/9).

Society for the Protection of Ancient Buildings, 55 Great Ormond Street, London WC1N 3JA. (01-405 2646).

Structural Insulation Association, Audley House, 9 Margaret Street, London W1N 7LF. (01-637 7031).

***Town and Country Planning Association,** 17 Carlton House Terrace, London SW1Y 5AS (01-930 8903).

CLEAN AIR

HM Alkali and Clean Air Inspectorate:
Chief Inspector, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London, SW1H 9JW (01-930 4300, ext. 76).
Deputy Chief Inspectors, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London, SW1H 9JW (01-930 4300, ext. 54, 61 and 541).
Chief Inspector for Northern Ireland, M. D. Hinchliff, Government of Northern Ireland, Ministry of Development, Alkali and Radiochemical Inspectorate. Stormont, Belfast, BT4 3SS (0232 63210).
Chief Inspector for Scotland, HM Industrial Pollution Inspectorate for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY (031-226 5208).

Clean Air Council, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London SW1H 9JU (01-930 4300, ext. 345).

Clean Air Council for Scotland, Scottish Development Department, Room F1/247, Government Buildings, Broomhouse Drive, Saughton, Edinburgh EH11 4XR (031-443 4040, ext. 142).

Derbyshire Advisory Council for Clean Air and Noise Control, Town Clerk's Office, Town Hall, Chesterfield (0246-77232).

Institution of Chemical Engineers, 16 Belgrave Square, London SW1X 8PT. (01-235 3637).

Institute of Petroleum, Atmospheric Pollution Committee, Secretary: P. Jones, 61 New Cavendish Street, London W1M 8AR (01-636 1004).

Manchester and District Regional Clean Air Council, Town Hall, Manchester M60 2JS (061-236 3377 ext. 2592).

Midlands Joint Advisory Council for Clean Air & Noise Control, Public Health Department, Ednam House, St. James's Road, Dudley, Worcs. (Dudley 55433 ext. 174).

National Society for Clean Air
Central Offices: 136 North Street, Brighton, BN1 1RG (Brighton 26313).
Scottish Division: Town Clerk's Office, 78 Cochrane Street, Glasgow (041-221 9600, ext. 2538).
Northern Ireland Division: 20 Kensington Gardens, Belfast BT5 6NP.
North West Division: Health Centre, Crescent, Salford, Lancs. (061-736 5891).
North East Division: Civic Centre, Barras Bridge, Newcastle upon Tyne (28520).
Yorkshire Division: Health Dept., 12 Market Building, Vicar Lane, Leeds 1 (30211, ext. 59).
East Midlands Division: Public Health Dept., County Borough of Derby, Castlefields House, Main Centre, Derby DE1 2FL (Derby 31111).
West Midlands Division: P.O. Box No. 47, Town Hall, Lombard Street West, West Bromwich.
South East Division: Public Health Dept., 8 Easton Street, High Wycombe (High Wycombe 26100).
South West Division: Public Health Inspector's Office, Union House, Union Street, Bristol BS1 (0272 26241).
South Wales and Monmouthshire: 9 Lodge Drive, Baglan, Port Talbot (5231).

Royal Institute of Chemistry, 30 Russell Square, London WC1B 5DT (01-580 3482).

Sheffield and District Clean Air Committee, Town Hall, Sheffield (0742 7340053).

Tees-side Clean Air Committee, Town Clerk's Office, Municipal Buildings, Middlesbrough, Teesside. (0642 48155).

Warwickshire Clean Air Council, The Council House, Southbank Road, Kenilworth, Warwickshire (Kenilworth 58131).

West Bromwich Clean Air Council, C. R. Cresswell, West Bromwich Corporation, P.O. Box 47, Town Hall, Lombard Street West, West Bromwich.

***West Lancashire and Cheshire Regional Smoke Abatement Committee,** c/o Health Department, Hatton Garden, Liverpool L3 2AW, or 6 Brougham Terrace, Liverpool L6 1AE (051-263 5511, ext. 1).

West Riding Advisory Council for Clean Air & Noise Control, The, Public Health Department, Provincial Insurance House, Bond Court, Leeds LS1 2TZ. (0532-30661).

FUEL AND ENERGY

British Coke Research Association, Chesterfield, Derbys. (Chesterfield 76821).

British Gas Corporation, The, 59 Bryanston Street, Marble Arch, London W1A 2AZ. (01-723 7030).

Central Electricity Generating Board, Sudbury House, 15 Newgate Street, London E.C.1. (01-248 1202).

***Coke Oven Managers' Association,** Waveney House, Adwick Road, Mexborough, Yorks S64 OBS.

College of Fuel Technology, 90 Talbot Road, Highgate, London N6 4RB (01-340 6972).

Combustion Engineers Association, Beaufort Chambers, 240B High Street, Slough, Bucks. (Slough 33211).

Domestic Solid Fuel Appliances Approval Scheme, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020, ext. 31).

***Electrical Association for Women,** 25 Foubert's Place, London W1V 2AL (01-437 5212/3).

Electrical Research Association, Cleeve Road, Leatherhead, Surrey (Leatherhead 74151). Telex 264045.

Electricity Council, 30 Millbank, London SW1P 4RD (01-834 2333).

Esso Petroleum Co. Ltd., Victoria Street, London S.W.1. (01-834 6677).

Institute of Fuel, 18 Devonshire Street, London W1N 2AU (01-580 7124).

***Institution of Electrical Engineers,** Savoy Place, London WC2R 0BL (01-240 1871).

Institution of Gas Engineers, 17 Grosvenor Crescent, London SW1X 7ES (01-245 9811).

Institution of Heating and Ventilating Engineers, 49 Cadogan Square, London SW1X 0JB (01-235 7671/2/3).

Low Temperature Coal Distillers' Association of Great Britain Ltd., P.O. Box No. 21, Chesterfield, Derbyshire (0246 822281/9).

***National Coal Board,** Hobart House, Grosvenor Place, London S.W.1 (01-235 2020).

NIFES (National Industrial Fuel Efficiency Service Ltd.).
Registered office:
54/58 Bartholomew Close, London, EC1A 7HD (01-606 5906).
Offices:
84 High Street, Buntingford, Herts. (0763 71154).
88 Cathedral Road, Cardiff, CF1 9LN (0222 33825).
Wellington House, 190, Derby Road, Nottingham, NG7 1NR (0602 44753).
26 Calthorpe Road, Edgbaston, Birmingham, B15 1RP (021-454 4471).
N.I.F.E.S. House, Sinderland Road, Broadheath, Altrincham, Cheshire, WA14 5HQ (061-928 5791).
Rawdon House, Green Lane, Yeadon, Nr. Leeds LS19 7BY (09737 5943).
26 Portland Terrace, Jesmond, Newcastle upon Tyne, NE2 1QJ (0632 813776).
6 Park Terrace, Glasgow, G3 6BY (041-332 2453).
49 Meadowside, Dundee, DD1 1EQ (0382 22179).

Shell-Mex and B.P. Ltd., P.O. Box No. 148, Shell-Mex House, Strand, London WC2 (01-836 1234).

Society of British Gas Industries, 17 Grosvenor Crescent, London SW1X 7ER (01-235 7169).

Solid Smokeless Fuels Federation, York House, Empire Way, Wembley, Middlesex HA9 0PA (01-902 5405).

Women's Solid Fuel Council, Hobart House, Grosvenor Place, London SW1P 1LA (01-235 2020).

Women's Gas Federation and Young Homemakers, Gaywood House, 29 Great Peter Street, London SW1P 3LW (01-222 3677/0).

GENERAL

City and Guilds of London Institute, 76 Portland Place, London W1N 4AA (01-580 3050).

National Council of Women of Great Britain, The, 36 Lower Sloane Street, London SW1W 8BP (01-730 0619).

National Council of Social Service, The, 26 Bedford Square, London WC1B 3HU (01-636 4066).

Royal Institution of Great Britain, 21 Albemarle Street, London W1X 4BS (01-493 0669 and 5716).

GENERAL ENVIRONMENT AND CONSERVATION BODIES

Committee for Environmental Conservation, 4 Hobart Place, London SW1W 0HY (01-235 9481).

Conservation Society, 34 Bridge Street, Walton-on-Thames, Surrey (Walton-on-Thames 41793).

Council for the Protection of Rural England, 4 Hobart Place, London SW1W 0HY (01-235 9481).

Council for the Protection of Rural Wales (Cymdeithas Diogelu Harddwych Cymru), Meifod, Montgomeryshire (Meifod 383).

Environmental Science Research Unit, College of Aeronautics, Cranfield Institute of Technology, Cranfield, Bedford (Bedford (0234) 51551).

National Trust for Places of Historical Interest or Natural Beauty, 42 Queen Anne's Gate, London S.W.1 (01-930 0211).

Royal Commission on Environmental Pollution, Church House, Great Smith Street, London SW1P 3BL (01-222 6991).

GOVERNMENT AND LOCAL BODIES

Association of County Councils in Scotland, 3 Forres Street, Edinburgh (031-225 1626/7).

Association of Municipal Corporations, 36 Old Queen Street, Westminster, London SW1H 9JE (01-930 9861).

Atomic Energy Research Establishment, Harwell, Didcot, Berks OX11 0RA (Abingdon 4141).

County Boroughs Association, Guildhall, Kingston upon Hull (Kingston upon Hull 223111).

***County Councils Association,** Eaton House, 66A Eaton Square, London SW1W 9BH (01-235 5173).

Department of the Environment, 2 Marsham Street, London S.W.1 (01-212 3434).
Clean Air Division: Queen Anne's Chambers, Tothill Street, London S.W.1 (01-930 4300).
(Also see Alkali and Clean Air Inspectorate).

Department of Trade and Industry, Industrial & Commercial Policy Division, 1 Victoria Street, London SW1H 0ET (01-222 7877).

Her Majesty's Stationery Office, Atlantic House, Holborn Viaduct, London EC1P 1BN (01-248 9876), and at Sovereign House, St. Georges Street, Norwich NOR 76A (Norwich 22211).

London Boroughs Association, Westminster City Hall, Victoria Street, London SW1E 6QW (01-828 8070).

Parliamentary and Scientific Committee, 14 Buckingham Palace Road, London SW1W 0QP (01-834 2608).

Rural District Council's Association, 25 Buckingham Gate, London SW1E 6LE (01-828 7425/8).

Scottish Counties of Cities Association, City Chambers, Edinburgh EH1 1YJ 031-225 2424).

Scottish Development Department, Room F1/247, Government Buildings, Broomhouse Drive, Saughton, Edinburgh EH11 4XR (031-443 4040, ext. 142).

Standing Conference of Co-operating Bodies, Warren Spring Laboratory (Department of Trade and Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

Warren Spring Laboratory (Department of Trade and Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

Urban District Council's Association, Alembic House, 93 Albert Embankment, London SE1 7TY (01-735 8235).

HEALTH

Association of Public Health Inspectors, 19 Grosvenor Place, London SW1X 7HH (01-235 5158/9).

British Medical Association, B.M.A. House, Tavistock Square, London WC1H 9JP (01-387 4499).

Department of Health and Social Security, Alexander Fleming House, Elephant and Castle, London SE1 6BY (01-407 5522).

Health Education Council, Middlesex House, Ealing Road, Wembley, Middlesex, HA0 1HH (01-998 2731).

***Institute of Hospital Engineering,** 20 Landport Terrace, Southsea, Hampshire PO1 2RG (0705 23186).

Institution of Public Health Engineers, 32 Eccleston Square, London SW1V 1PB (01-834 3017).

Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical College, Charterhouse Square, London E.C.1. (01-253 1537).

Royal Institute of Public Health and Hygiene, 28 Portland Place, London W1N 4DE (01-580 2731/2).

Royal Sanitary Association of Scotland, The, 113 West Regent Street, Glasgow G2 2RU (041-248 7955).

Royal Society of Health, 13 Grosvenor Place, London SW1X 7EN (01-235 9961/5).

Society of Community Medicine, Tavistock House South, Tavistock Square, London WC1H 9LD (01-387 3923).

INDUSTRY, INSTRUMENTS AND STANDARDS

British Industrial Measuring and Control Apparatus Manufacturers' Association, 23/24 Margaret Street, London W1N 7LB (01-580 9336).

British Oil and Gas Firing Equipment Manufacturers' Association, The Fernery, Market Place, Midhurst, Sussex GU29 9DP (073081 2782).

British Standards Institution, British Standards House, 2 Park Street, London W1A 2BS (01-629 9000).

Confederation of British Industry, 21 Tothill Street, London SW1H 9LP (01-930 6711).

Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ (01-839 1211).

Institution of Plant Engineers, 138 Buckingham Palace Road, London SW1W 9SG (01-730 0469).

Scientific Instrument Manufacturers' Association of Great Britain, 20 Peel Street, London W8 7PD (01-727 2614).

***Sira Institute,** South Hill, Chislehurst, Kent (01-467 2636).

IRON AND STEEL

***BISRA—The Corporate Laboratories, British Steel Corporation,** 24 Buckingham Gate, London S.W.1 (01-828 7931).

British Cast Iron Research Association, Alvechurch, Birmingham B48 7QB (Redditch 66414).

British Independent Steel Producers Association, 5 Cromwell Road, London SW7 2HX (01-581 0231).

British Steel Corporation, P.O. Box 403, 33 Grosvenor Place, London S.W.1 (01-235 1212).

Council of Ironfoundry Associations, 14 Pall Mall, London SW1Y 5LZ (01-930 7171).

Institution of Corrosion Technology, The, 14 Belgrave Square, London SW1X 8PS (01-245 9189).

Steel Castings Research and Trade Association, East Bank Road, Sheffield S2 3PT (0742 28647).

METEOROLOGY

Meteorological Office, London Road, Bracknell, Berkshire (0344 20242).

Meteorological Office, Weather Centres
Forecasts, London: 01-836 4311
Glasgow: 041-248 3451
Manchester: 061-832 6701
Newcastle: 0632 26453
Southampton: 0703 28844
Nottingham (Watnall): 060-75 3311.

***Royal Meteorological Society,** Cromwell House, High Street, Bracknell, Berks. (Bracknell 22957).

TRANSPORT

British Internal Combustion Engine Research Institute Ltd., 111-112 Buckingham Avenue, Slough, Bucks SL1 4PH (Slough 27371).

Institute of Road Transport Engineers, The, 1 Cromwell Place, Kensington, London SW7 2JF (01-589 3744).

Motor Industry Research Association, The, Watling Street, Nuneaton, Warwickshire (Nuneaton 68541).

Road Haulage Association Ltd., The, 22 Upper Woburn Place, London WC1 (01-387 9711).

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Air Pollution Control Branch, N.S.W. Department of Health, P.O. Box 163, Lidcombe, N.S.W. 2141.
Department of Public Health, Box 65, Rundle Street, Adelaide, S.A. 5000.
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Environmental Protection Authority, 232 Victoria Pde., East Melbourne, Vic.
Department of Public Health, 57 Murray St., Perth, W.A. 6000.

Austria
Austrian Association for Industrial Medicine, Schwarzspanierstrasse 17, A1090 Vienna.

Belgium
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2. Czechoslovak Academy of Sciences, Institut for Physics of the Atmosphere, Boční 11, Praha 4.
3. Institute of Hygiene and Epidemiology, Institute of General and Communal Hygiene, Šrobárova 48, Praha 10.
4. Power Research Institute, Partyzánská 7a, Praha 7.
5. Research Institute of Air Engineering, Počernická 96, Praha 10.
6. Hydrometeorological Institute, Department for Air Pollution Prevention, Pujmanové V-8, Praha 4.
7. State Technical Inspection for Air Pollution Control, Italská 27, Praha 2.
8. Czechoslovak Research and Development Center for Environmental Pollution Control — UNO/WHO Programme, Bratislava—Karlova Ves.

Denmark
*Dansk Kedelforening and Danish Air Pollution Laboratory, Sankt Peders Vej 8, 2900 Hellerup.
National Health Service of Denmark, 1 St. Kongensgade, 1264 Copenhagen K.

Finland
*Finnish Council for Air Conservation and Noise Abatement, Haartmaninkatu 1, 00290 Helsinki 29.
Ministry of Interior Affairs, Hallituskatu 4 E, 00170 Helsinki 17.

France
Association pour la Prévention de la Pollution Atmosphérique. M. Yvan QUERET, 62, rue de Courcelles, 75—PARIS 8°
Association Technique de l'Industrie du Gaz en France, 62, rue de Courcelles, 75—PARIS 8°
Centre d'Information pour le Dévelopement de Conditionnement d'Air, de la Ventilation, du Filtrage de l'Air et du Dépoussierage, 38, rue Copernic 75—PARIS 16°
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Centre National de la Recherche Scientifique (C.N.R.S.) 15, quai Anatole France 75—PARIS 7°
Délégation Générale à la Recherche Scientifique et Technique 103, rue de l'Université 75—PARIS 7°
Electricité de France, 75—PARIS 8°
Professeur ROUSSEL, 11 bis rue de Milan, 75—PARIS 9°
Institut Français des Combustibles et de l'Energie, 3 rue Henri Heine, 75—PARIS 16°
Institut Français du Pétrole (I.F.P.) 1 et 4 avenue Bois Préau 92—RUEIL MALMAISON.
Institut National de Recherche Chimique Appliquée, 12, Quai Henry IV 75—PARIS 4°
Laboratoire Central de la Préfecture de Police, 39, bis rue de Dantzig 75—PARIS 15°
Laboratoire "Prévention de la Pollution Atmosphérique" d'Electricité de France, 1, quai de Saint Ouen 93—SAINT DENIS.
Société Française des Pétroles BP, 21 rue de la Bienfaisance, 75—PARIS 8°
Union Européenne de Médecine Sociale, 21 rue Murillo 75—PARIS 8°

Germany
*Abgasprüfstelle der DDR, Rudower Chaussee 6, 1199 Berlin-Adlershof.
Agrikulturchemisches Institut, Am Vogelsang 14, 5628 Heiligenhaus Bez. Düsseldorf.

Bundesgesundheitsamt, Institut für Wasser-, Boden- und Lufthygiene, Corrensplatz 1, 1000 Berlin 33.
Bundesministerium des Innern, Rheindorfer Str. 198, 5300 Bonn.
Deutsche Gesellschaft für Mineralölwissenschaft und Kohlechemie e.V., Mittelweg 180, 2000 Hamburg 13.
Deutscher Städtetag, Lindenallee 11, 5000 Köln-Marienburg.
Deutscher Verein von Gas- und Wasserfachmännern, Beethovenstr. 17, 6000 Frankfurt (Main).
Gaswärme-Institut Essen e.V., Holbeckshof, 4300 Essen-Steele.
Hygienisches Institut, Neuer Kamp 25, 2000 Hamburg 6.
Hygiene-Institut der Humboldt-Universität, Otto-Grotewohl-Str. 1, 108 Berlin, DDR.
Institut für Gewerbliche Wasserwirtschaft und Luftreinhaltung e.V., Oberländer Ufer 84-88, 5000 Köln 51.
Institut für Grubensicherheit und Arbeitsschutz, Kirchgasse 11, Freiberg/Sa., DDR.
Institut für Technische Physik der Frauen-hofer-Gesellschaft, Königstr. 70/74, 7000 Stuttgart-Degerloch. Director: Prof. Dr.-Ing. Gösele.
International Union for Conservation of Life (IUCL) Secretariate: Institut für Biologie und Lebensschutz, 6229 Schlangenbad-Georgenborn.
Landesinstitut für Arbeitsschutz und Arbeitsmedizin, Kaiserallee 61, 7500 Karlsruhe.
Landesanstalt für Immissions- und Boden-nutzungsschutz des Landes Nordrhein-Westfalen, Wallneyer Str. 6, 4300 Essen.
Rhein.-Westf. Technischer Überwachungs-Verein e.V., Steubenstr. 53, 4300 Essen.
Ruhrkohlen-Beratung GmbH, Frau-Bertha-Krupp-Str. 4, 4300 Essen.
Staubforschungsinstitut des Hauptverbandes, der Gewerblichen Berufsgenossenschaften e.V., Langwartweg 103, 5300 Bonn.
Steinkohlenbergbauverein, Friedrichstr. 2, 4300 Essen.
Verein Deutscher Eisenhüttenleute, Breite Str. 27, 4000 Düsseldorf.
Verein Deutscher Ingenieure (VDI)—Kommission Reinhaltung der Luft—Graf-Recke-Str. 84, 4000 Düsseldorf, Secretary: N. Endell.
Vereinigung der Großkesselbetreiber e.V., Klinkestr. 29/31, 4300 Essen.
Vereinigung de Technischen Überwachungs-Vereine e.V. 43 Essen, Rott str. 17.

India
All-India Institute of Hygiene & Public Health, Section of Physiological & Industrial Hygiene, Calcutta.
Central Public Health Engineering Research Institute, Nehru Marg, Nagpur-3.
Bhabba Atomic Research Centre, Health Physics Division, Trombay, Bombay.

***Israel**
Ministry of Health, Division for Air Pollution and Radiation Control, 27 Prof. Shor Street, Tel-Aviv.
Public Council for the Prevention of Noise and Air Pollution in Israel, Tel-Aviv, P.O. Box 6335.

Italy
Consiglio Nazionale delle Ricerche Piazzale delle Scienze 7, Rome.
ILVA Society, Via Corsica 4, Genoa.
Institute of Hygiene, University of Ferrara, Corso Giovecca 173A, Ferrara.
Institute of Hygiene, University of Genoa, Via A. Pastore 1, Genoa.
Instituto di Ingegneria Sanitaria del Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milan.
Istituto Superiore di Sanità, Viale Regina Elena 299, Rome.
N.A.N.S. (Union of Nations for Fight against Noise and Smog), Belvedere Golfo Paradiso 49-16036-Recco-Genova.
Stazione Sperimentale per i Combustibili, Viale De Gasperi 3, San Donato Milanese, Milan.

***Japan**
The Institute of Public Health, 1-39, Shiba Shirogane Daimachi, Minato-ku, Tokyo.
Kanto-Shin-Etsu Heat Control Society, 54 Takata-Oimatsu-cho, Bunkyo-ku, Tokyo.
Osaka Institute of Hygiene, 38 Kitaogimachi, Kita-Ku, Osaka.

Malta
National Society for Clean Air, 8-10 Civic Centre, Senglea.

Mexico
Asociacion Mexicana Contra la Contaminacion del Agua y del Aire, A.C., Torre de Ciencias 5° Piso, Ciudad Universitaria, México 20, D.F., México.

Netherlands
*Environmental Health Division, Municipal Health Service, Baan 170, Rotterdam.
Duinweg, The Hague.
Central Organisation T.N.O., 148
Atmospheric Pollution Division, 14 Juliana van Stolberglaan, P.O. Box 148, The Hague.
Council for Air Pollution, Zeestraat 73, The Hague.
Netherlands Association for Water, Soil and Air Pollution, Nieuwe Achtergracht 100, Amsterdam.
Research Institution for Public Health Engineering T.N.O. (organisation for Health Research T.N.O.) Industrial Air Pollution Division, 97 Schoemakerstraat, Delft.
Stichting Concawe (International Study Group for Conversation of Clean Air and Water in Western Europe). Secretary E. H. Hubbard, 21 President Kennedylaan, The Hague.
SICOM, Stichting International Contactorgaan Milieubescherming, Postbus 214, Delft, The Netherlands.

New Zealand
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Norwegian State Council for Air Pollution Abatement, Røykskaderädet, Oslo Dep., Oslo 1.
Norwegian Institute for Air Research, P.O. Box 15, N-2007 Kjeller/Oslo, Norway.
SINTEF avd. 21, 7034 Trondheim—NTH, Norway.
Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.), Den Norske Ingeniørforening, Kronprinsensgate 17, Oslo 2, Norway.

Poland
*The Ministry of Local Economy and Environment Protection, Nowogrodzka 1/3, Warsaw.

Portugal
*Instituto Superior Ciencias, Sociais Universidade Técnica, Lisbon.

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Chemical Engineering Research Group of the Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, Transvaal.
D. Giles and Co. (Scientific) (Pty) Ltd., P.O. Box 3891, Johannesburg, Transvaal.
National Association for Clean Air, P.O. Box 5777, Johannesburg, Transvaal.
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Swedish Water and Air Pollution Research Laboratory, Djurgårdsgatan 26, Box 4052 S-40040, Göteborg 4.
International Meteorological Institute in Stockholm, P.O.B. 19111, 10432 Stockholm 19.
Swedish Meteorological and Hydrological Institute, Fridhemsgatan 9, Box 12108, S-10223 Stockholm.
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AB Svenska Fläktfabriken, Box 20 040, S-10460 Stockholm 20.

Switzerland
Eidgenössische Kommission für Lufthygiene, Monbijoustr, 8, 3003 Berne.
Schweiz. Vereinigung für Gesundheitstechnik (SVG), Postfach 305, 8035 Zurich, Switzerland.

U.S.A.
Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, 15213.
Bituminous Coal Research Inc., 35 Hochberg Road, Monroe, Pittsburgh 13, PA.
National Air Pollution Control Administration, 801 N. Randolph Street, Arlington, Virginia 22203.

Other U.S. Governmental Air Pollution Agencies and individual State Agencies are listed in an annual Directory published by the Air Pollution Control Association in co-operation with the U.S. Dept. of Health, Education and Welfare. A copy of this Directory is available at the library of the National Society for Clean Air.

Uruguay
*Asociacion Uruguaya Contra la Contaminacion del Aires, Calle Colonia 1422, P.6, Ap. 601 Montevideo, Uruguay.

U.S.S.R.
*Institute of Communal Hygiene, Pogodinskaja 10, Moscow.
Medical Control Committee on Air Pollution, State Medical Commission, Moscow.

Division of Environmental Health, World Health Organisation, Avenue Appia, 1211 Geneva 27, Switzerland.

The United Nations Economic Commission for Europe
Division of Environment and Housing, Palais des Nations, Geneva, Switzerland.

Yugoslavia
Yugoslav Society for Clean Air, 71000 Sarajevo, Masinski fakultet, Yugoslavia.

*Entry taken from last issue of "Clean Air Year Book" as no reply received from enquiry.

TRADE DIRECTORY AND BUYERS GUIDE

page
Air Conditioners (Domestic) ... 89
Air Conditioning Equipment ... 89
Air Pollution Measurement ... 89
Anti-Soot and Corrosion Treatment ... 89
Automatic Control Equipment ... 89

Bifurcated Fans (PVC and Polypropylene) ... 90
Blowers ... 90
Boilers, Domestic ... 90
Boilers, Industrial ... 90
Boilers, Industrial (Solid Fuel) ... 90
Boilers, Industrial (Waste-Fired) ... 90
Boilers, Packaged (Oil-Fired) ... 90
Brickwork, Boiler Setting ... 90
Burners, Gas ... 90
Burners, Oil... ... 90
Burners, Solid Fuel ... 91

Canopy Hood ... 91
Catalytic Air Pollution Control Units ... 91
Ceilings, Heated ... 91
Centrifugal Fans (PVC and Polypropylene) ... 91
Chimneys ... 91
Chimneys (Insulated) ... 91
Chimney Cladding (Aluminium) ... 91
Chimney Linings ... 91
Clean Rooms ... 91
Coal Handling Plant ... 92
Contractors, Heating, Ventilating & Air Conditioning ... 92
Coolers ... 92
Cyclones ... 92

Dampers, Gas-Tight ... 92
Dehumidifiers ... 92
Discharge Valves ... 92
Ducting ... 92
Duct Heaters ... 92
Dust Classification Plant ... 92
Dust Collection Equipment ... 92
Dust Collection Equipment & Plant ... 92
Dust Collectors ... 93
Dust Collector Filter Media ... 93
Dust Sampling Equipment ... 93

Electrostatic Precipitators ... 93
Electrostatic Unit Air Cleaners ... 94

Fabric Filters ... 94
Fans ... 94
Filters ... 94
Filters, Air ... 94
Filters, Dust ... 94
Filters, Electrostatic Oil Mist ... 95
Filter Paper ... 95
Flares ... 95
Flue Dust Extraction Plant ... 95
Flue Gas Dust Sampling Equipment (C.E.G.B. Type) 95
Flue Gas Dust Sampling Epuipment (B.C.U.R.A. Type) 97
Flue Gas Treatment ... 95
Fuel Additives ... 95
Fuel - Electricity Supply ... 95

page
Fuel Oil Combustion Improver ... 95
Fuel Oil Conditioner ... 95
Fuels (Solid Smokeless) ... 95
Fume Removal Equipment ... 95
Furnaces, Kilns, Ovens, etc. ... 96

Gas Cleaning Plant ... 96
Gas H_2S ... 97
Gas Heating Equipment (Butane/Propane) ... 97
Gas Scrubbers & Washers ... 97
Gas Unit Heaters ... 97
Grit Arresters ... 97

Heat Exchangers ... 97
Heaters, Air ... 97
Heaters - Infra Red ... 97
Heating Equipment, Industrial (Process Space) ... 98
Humidifiers ... 98

Incandescent/Whiting Wet Arresters for Cupolas ... 98
Incinerators ... 98
Instruments, Gauges, Meters, etc. ... 98

Laboratory Fume Cabinets ... 98
Lecture, Filmstrips & Notes ... 98

Odour Control ... 98

Pollution Control Advisory Services ... 99
Pumps ... 99

Radiant Heating ... 99
Refrigeration Plant ... 99
Research and Development Facilities ... 99
Roof Ventilators (PVC) ... 99
Room Heaters - Gas ... 99

Scrubbers ... 99
Sleeves & Tubes (For Fabric Filters) ... 99
Smoke Density Gauges & Meters ... 100
Smoke Indicators ... 100
Smut Inhibitors ... 100
Stokers, Industrial ... 100

Tanks and Tank Linings ... 100
Thermal Storage Systems ... 100
Towers ... 100

Unit Dust Collectors ... 100

Vacuum Cleaning ... 100
Ventilators ... 100

Warm Air Heating Systems ... 100
Waste Fuel Boiler Plant ... 100
Waste Heat Recovery ... 101
Waste Material Disposal Furnaces ... 101
Wet Arresters ... 101

AIR CONDITIONERS (DOMESTIC)

John Bass Limited
John Bass Works, Ashley Crescent (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd", offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

W.H.S. (Pathfinder) Ltd.
Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

AIR CONDITIONING EQUIPMENT

AAF Ltd.
Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Aeronca International Ltd.
Penarth Road, Cardiff CF1 7UG (Cardiff 387873).
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).

John Bass Ltd.
John Bass Works, Ashley Crescent, (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd." offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

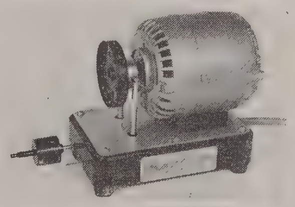
Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London SW1E 5EL (01-834 6858) Telex 23581.
Air Conditioning Division, York Towers, York Road, Leeds LS9 6TP (0532-40061).
The Air Conditioning Division of Carrier Engineering Company design and install air conditioning, electrical and mechanical services for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised applications.

Felvic Industries
21 Napier Road, Bromley, BR2 9JA, Kent (01-464 6515) Telex 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

W.H.S. (Pathfinder) Ltd.
Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

AIR POLLUTION MEASUREMENT

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Weybridge, Surrey KT14 7PB (Byfleet 43224/5). Telegrams: Capumps Byfleet. Telex 928368.



The Dymax Mk. II 'oil free' diaphragm pump (illustrated) will displace 3 litres of air or gas per minute. It is one of a range of pumps covering flow rates from 0.5 to 70 litres per minute. Further details from Charles Austen Pumps Ltd.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts, SG1 2DE (Stevenage 3101-5) Telex 82385.
Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ—500μ), Radio Active Particle Measuring Equipment and H_2S Gas Monitors (10ppm Alarm Level).

Johnson Matthey Chemicals Ltd.
74 Hatton Garden, London EC1P 1AE (01-405 6989).
Abatement of odours or organic content of air/steam by means of Honeycat$^{(R)}$ air pollution control catalytic incineration.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

W.H.S. (Pathfinder) Ltd.
Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

ANTI-SOOT AND CORROSION TREATMENT

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
Manganese/amine fuel additive. Scavenge, soot and deposit remover.

AUTOMATIC CONTROL EQUIPMENT

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts (St. Albans 61451). Telex 265930. Cables: Jonzin, St. Albans.

BIFURCATED FANS (PVC AND POLYPROPYLENE)

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
Trade Name: Placon. The Plastic Construction Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

W.H.S. (Pathfinder) Ltd.
Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

BLOWERS

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.
Turbo exhausters and blowers can supply air free from moisture or oil. Rotary piston blowers, precision made, robust, suitable for use in countless fields of application from nuclear engineering to the refrigeration industry.

BOILERS, DOMESTIC

Ideal-Standard Ltd.
P.O. Box 60, Kingston Upon Hull (Hull 46461).
Product: Concord RS/CF (Gas); E Type (Gas); Concord W50 (Gas); Concord H (Gas).

BOILERS, INDUSTRIAL

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Hoval Boilers Ltd.
Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Herts EN6 3AR (Potters Bar 57201) Telex 261076.
Works: Hoval Farrar Boilers Ltd., Newark-on-Trent, Notts.

BOILERS, INDUSTRIAL (SOLID FUEL)

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

BOILERS, INDUSTRIAL (WASTE-FIRED)

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

BOILERS, PACKAGED (OIL-FIRED)

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

BRICKWORK, BOILER SETTING

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

BURNERS, GAS

Auto Combustions (London) Ltd.
360/364 Wandsworth Road, London SW8 4TF (01-622 9121) Telex: Swirlamiser Chamcom/London 888941.

Trade Name: 'Swirlamiser'. Manufacturers of Swirlamiser oil and gas burners and dual fuel oil/gas high velocity burners and Autoflame oil burners for process heating and all other purposes, furnaces, ovens, heaters, heat exchangers, boilers, water/oil emulsion firing.

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA (01-733 1181).

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

BURNERS, OIL

Auto Combustions (London) Ltd.
360/364 Wandsworth Road, London SW8 4TF (01-622 9121) Telex: Swirlamiser Chamcom/London 888941.
Trade Names: 'Swirlamiser' and 'Autoflame'. Manufacturers of Swirlamiser oil and gas burners and dual fuel oil/gas high velocity burners and Autoflame oil burners for process heating and all other purposes, furnaces, ovens, heaters, heat exchangers, boilers, water/oil emulsion firing.

Babcock and Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
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Peabody Ltd.
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Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

BURNERS, SOLID FUEL

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

CANOPY HOOD

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

CATALYTIC AIR POLLUTION CONTROL UNITS

Johnson Matthey Chemicals Ltd.
74 Hatton Garden, London EC1P 1AE (01-405 6989).
Abatement of odours or organic content of air/steam by means of Honeycat$^{(R)}$ *air pollution control catalytic incineration.*

CEILINGS, HEATED

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA (01-733 1181).
Phoenix Slimline suspended, gas fired, infra-red radiant heating systems for offices, shops, schools, etc. features: draft-free warmth, recessed installation or attractive exposed appearance, avoids condensation problems, gives 92% fuel efficiency and is compatible with air conditioning.

CENTRIFUGAL FANS (PVC AND POLYPROPYLENE)

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
Trade Name: Placon. The Plastic Construction Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

CHIMNEYS

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274-4066).
Woodlands Road, Mere, Warminster, Wilts (074-786 481).
28 Birmingham Street, Oldbury, Warley, Worcs (021-552 2039).

Beauvent steel chimneys; Beauvent Insulflo insulated double shell steel chimneys; Beaumere multi-bore insulated steel chimneys incorporating oil and water storage tanks; Beaudec G.R.P. contact cladding; Beauvent Econoflu self-supporting multi-taper steel chimneys.

CHIMNEYS (INSULATED)

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274-4066).
Woodlands Road, Mere, Warminster, Wilts (074-786 481).
28 Birmingham Street, Oldbury, Warley, Worcs. (021-552-2039).

Beauvent Insulflo insulated double shell steel chimneys; Beaumere multi-bore insulated steel chimneys incorporating oil and water storage tanks; Clements Beauvent multi-flue insulated steel chimneys; Beauvent Concentriflu concentri-bore insulated steel chimneys.

CHIMNEY CLADDING (ALUMINIUM)

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274 4066).

Beauval aluminium insulation cladding for Beauvent chimneys; Beauval Supercladding heavy duty insulation for Beauvent chimneys.

CHIMNEY LININGS

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER (01-274 4066).

Beauvent insulated steel chimney liners for industrial steel chimneys.

CLEAN ROOMS

John Bass Ltd.
John Bass Works, Ashley Crescent, (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd." offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham B12 0LP (021-772 5102/3).
Dashwood Avenue, High Wycombe, HP12 3DP, Bucks (High Wycombe 22744).

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

W.H.S. (Pathfinder) Ltd.
Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

COAL HANDLING PLANT

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

CONTRACTORS, HEATING, VENTILATING & AIR CONDITIONING

Carrier Engineering Company Ltd.

Carrier House, Warwick Row, London SW1E 5EL (01-834-6858) Telex 23581.
Air Conditioning Division, York Towers, York Road, Leeds LS9 6TP 0532-40061).

The Air Conditioning Division of Carrier Engineering Company design and install air conditioning, electrical and mechanical services for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised applications.

W.H.S. (Pathfinder) Ltd.

Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).

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Constant Air Systems Ltd.

Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham B12 0LP (021-722 5102/3).
Dashwood Avenue, High Wycombe, HP12 3DP, Bucks (High Wycombe 22744).

COOLERS

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

CYCLONES

Modern Air Systems (Leicester) Ltd.

Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

DAMPERS, GAS-TIGHT

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).

Gas Cleaning and Dust Collection Plant and Services.

DEHUMIDIFIERS

W.H.S. (Pathfinder) Ltd.

Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).

W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

DISCHARGE VALVES

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).

Gas Cleaning and Dust Collection Plant and Services.

Plastic Constructions Ltd.

Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.

The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

DUCTING

Plastic Constructions Ltd.

Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.

The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

DUCT HEATERS

John Zink Company Ltd.

Acrewood Way, St. Albans, Herts (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

DUST CLASSIFICATION PLANT

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).

Gas Cleaning and Dust Collection Plant and Services.

DUST COLLECTION EQUIPMENT

Collectron (Dust Control) Ltd.

5 Greenhills Road, Charlton Kings, Cheltenham, Gloucestershire GL53 9ED (Cheltenham 56355).

Modern Air Systems (Leicester) Ltd.

Barkby Road, Leicester LE4 7LG. (Leicester 766316-7-8).

DUST COLLECTION EQUIPMENT & PLANT

Aeronca International Ltd.

Penarth Road, Cardiff CF1 7UG (Cardiff 387873).
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).

AAF Ltd.

Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).

International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Airmaster Engineering Ltd.

Olympia Works, Roundhay Road, Leeds LS8 4BH (Leeds 656494) Telex 557227.

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Centri-Spray International

Green Dragon House, 64/70 High Street, Croydon, CR9 1LG, Surrey (01-688-7431). Telex 261251.

Centri-Spray S.A.R.L.

3/5 Rue Talma, 75016 Paris, France.

Centri-Spray International GmbH

5159 Tuernich/Koeln, Fichten Str. 15, Germany.

Collectron (Dust Control) Ltd.

5 Greenhills Road, Charlton Kings, Cheltenham, Gloucestershire GL53 9ED (Cheltenham 56355).

Manufacturers and suppliers of the Collectron re-cycling type of patented cyclone and the high velocity adjustable throat agglomerator.

Constant Air Systems Ltd.

Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham B12 0LP (021-772 5102/3).
Dashwood Avenue, High Wycombe HP12 3DP, Bucks (High Wycombe 22744).

Dust Control Equipment Ltd.

Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

Howden Engineering Ltd.

Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Modern Air Systems (Leicester) Ltd.

Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Nailsea Engineering Co. Ltd.

The Grange, East Park Road, Blackburn, Lancashire (Blackburn 63911).
(Pnu-Jet dust filters and collectors) Pnu-Jet dry dust collectors and filters are manufactured by Nailsea Engineering Co. Ltd. of Blackburn. Applications particularly in mining, quarrying and road stone preparation. Nailsea equipment is guaranteed to cope with the requirements of the Alkali Act.

Newell Dunford Engineering Ltd.

143 Maple Road, Surbiton, Surrey KT6 4BD (01-546 7799) Telex: London/Telex 22413.
A member of the Dunford & Elliott Group.
Newell Dunford Engineering's Thermix line is well known in heavy industry. Shrewd engineers who have to cope with really difficult air pollution problems appreciate the full complement of equipment available which includes: Tubix multitubular centrifugal collectors, Airmix wet collectors, Thermix cloth filter dust arrestors, high temperature filters, dust valves, exhaust fans and pneumatic conveying equipment.

Peabody Ltd.

17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Spencer & Halstead Ltd.

Ossett, Yorkshire WF5 9AW (Ossett 5121) Telex 55201.

SPENSTEAD

Spencer & Halstead, specialists in Air Pollution Control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems, and a full filter media service.

Sturtevant Engineering Co. Ltd.

Hamlyn House, Highgate Hill, London N19 5PP (01-272 0233) Telex 263206.
Multi-cyclone dust and powder collections enable the recovery of saleable fines and minimise air pollution. These machines are suitable for the food industry.

Tilghman Wheelabrator Ltd.

Broadheath, Altrincham, Cheshire WA14 5EP (061-928 4242).
(Air Pollution Control Engineers).
Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

DUST COLLECTOR FILTER MEDIA

Bury & Masco Industries Ltd.

Needlefelt Division, Myrtle Grove, Waterfoot, Rossendale BB4 7JL, Lancs (Rossendale (07-062) 28365).
"Webron"—technical needlefelt designed for fabric dust collectors and liquid/solid separation. Webron filter fabric is available in polyester, polypropylene, arcrylonitrile, also high temperature polyamide and P.T.F.E. fibres.

Modern Air Systems (Leicester) Ltd.

Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Spencer & Halstead Ltd.

Ossett, Yorkshire WF5 9AW (Ossett 5121) Telex 55201.

SPENSTEAD

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Broadheath, Altrincham, Cheshire WA14 5EP (061-928 4242).
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Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

DUST COLLECTORS

Collectron (Dust Control) Ltd.

5 Greenhills Road, Charlton Kings, Cheltenham, Gloucestershire GL53 9ED (Cheltenham 56355).

Sturtevant Engineering Company Ltd.

Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.
Multi cyclone dust and powder collections enable the recovery of saleable fines and minimise air pollution. These machines are suitable for the food industry.

DUST SAMPLING EQUIPMENT

Fleming Instruments Ltd.

Caxton Way, Stevenage, Herts, SG1 2DE (Stevenage 3101-5) Telex 82385.
Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ—500μ), Radio Active Particle Measuring Equipment and H_2S Gas Monitors (10ppm Alarm Level).

ELECTROSTATIC PRECIPITATORS

AAF Ltd.

Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Howden Engineering Ltd.

Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex TW13 6DQ (01-898 5911) Telex 24692. Telegrams: Godfreypart London.
195 Scotland Street, Glasgow G5 8PJ (041-429 2131) Telex 77439. Telegrams: Howden Glasgow.
14/16 Cockspur Street, London SW1 (01-930 1353). Telegrams: Preheating London.
Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd. is especially interested in the engineering of inert gas systems, air pollution control, desalination plants, control of effluents, sewage treatment; backed up by Howden expertise in air/gas handling, hydraulics, etc.

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Sturtevant Engineering Company Ltd.

Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.
Easily maintained precipitators. Specially designed for gas cleaning, in power stations, cement works, refuse disposal installations etc. Efficiency up to 99.99% obtained. "Industrap" modular unit also available for smaller applications.

ELECTROSTATIC UNIT AIR CLEANERS

Bel Sound Products Company

21 Greenfield, The Ryde Estate, Hatfield, Herts (07072-62915).

FABRIC FILTERS

AAF Ltd.

Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Bury & Masco Industries Ltd.

Needlefelt Division, Myrtle Grove, Waterfoot, Rossendale BB4 7JL, Lancs (Rossendale (07-062) 28365).
"Webron"—technical needlefelt designed for fabric dust collectors and liquid/solid separation. Webron filter fabric is available in polyester, polypropylene, arcrylonitrile, also high temperature polyamide and P.T.F.E. fibres.

Lodge-Cottrell Ltd.

George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Modern Air Systems (Leicester) Ltd.

Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Peabody Ltd.

17-28 Garratt Lane, London SW18 4BY (01-874 6491) Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Tilghman Wheelabrator Ltd.

Broadheath, Altrincham, Cheshire WA14 5EP (061-928 4242).
(Air Pollution Control Engineers).
Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

FANS

Modern Air Systems (Leicester) Ltd.

Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Plastic Constructions Ltd.

Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
Trade Name: Placon. The Plastic Construction Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

Spencer & Halstead Ltd.

Ossett, Yorkshire WF5 9AW (Ossett 5121) Telex 55201.
Spencer & Halstead, specialists in air pollution control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems, and a full filter media service.

Sturtevant Engineering Company Ltd.

Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.
S 200 Series Radialine fans with backward aerofoil blades in tubular housing for optimum performance with straight through air flow. Suitable for heating ventilating and industrial applications.
S 400 Series paddle bladed fans for handling materials in powder or granular form.
SE 500 Series Monogram Cast Iron fans with radial or curved bladed impeller for diverse industrial applications.
SE 1000 Series forward curved fans for many applications requiring high gas flow at low pressure.
S 8000 Series aerofoil bladed fans for a wide range of industrial uses needing high throughput with low power requirements.

FILTERS

Sturtevant Engineering Company Ltd.

Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.
Electrostatic air filters from 1 sq. ft. area upwards for heating and ventilating and light industrial uses. They feature high efficiencies of up to 99%. Viscous type air filters. "Hampton" heavy duty filter panels which are washable.

FILTERS, AIR

AAF Ltd.

Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

John Bass Ltd.

John Bass Works, Ashley Crescent, (Sholing), Woolston, Southampton, Hants. (Southampton 49902).
John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd." offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Felvic Industries

21 Napier Road, Bromley, BR2 9JA, Kent (01-464 6515) Telex: 896501.
Humidity and Temperature Control: Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

Nailsea Engineering Co. Ltd.

The Grange, East Park Road, Blackburn, Lancashire (Blackburn 63911).
(Pnu-Jet dust filters and collectors) Pnu-Jet dry dust collectors and filters are manufactured by Nailsea Engineering Co. Ltd. of Blackburn. Applications particularly in mining, quarrying and road stone preparation. Nailsea equipment is guaranteed to cope with the requirements of the Alkali Act.

Spencer & Halstead Ltd.

Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.
Spencer & Halstead, specialists in air pollution control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems, and a full filter media service.

Sturtevant Engineering Company Ltd.

Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.

Tilghman Wheelabrator Ltd.

Broadheath, Altrincham, Cheshire WA14 5EP (061-928 4242).
(Air Pollution Control Engineers).
Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

W.H.S. (Pathfinder) Ltd.

Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

FILTERS, DUST

AAF Ltd.

Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Buell Ltd.

George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Dust Control Equipment Ltd.

Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874 6491) Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.

FILTERS, ELECTROSTATIC OIL MIST

Sturtevant Engineering Company Ltd.
Hamlyn House, Highgate Hill, London N19 (01-272 0233) Telex 263206.
For industrial applications involving oil fume removal with efficiencies of up to 99%.

FILTER PAPER

Evans, Adlard & Co. Ltd.
Postlip Mills, Winchcombe, Cheltenham, Glos., GL54 5BB (0242-602227) Telex 43316 (*Postlip Filter Paper*).

FLARES

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

FLUE DUST EXTRACTION PLANT

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Head Wrightson Process Engineering Ltd.
London Projects Office: 16/22 Baltic Street, London EC1Y 0TD (01-253 1299 Cables: Processes, London EC1.
Head Wrightson supply a complete range of flue dust extraction plants which include dry-electrostatic precipitators, irrigated precipitators, fabric filters, multi-cyclones, gas washers and a high efficiency flooded disc scrubber with no blockade throat or sprays.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

FLUE GAS DUST SAMPLING EQUIPMENT (C.E.G.B. TYPE)

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

FLUE GAS DUST SAMPLING EQUIPMENT (B.C.U.R.A. TYPE)

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

FLUE GAS TREATMENT

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871) (*Dolomite/Magnesite*).

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Sturtevant Engineering Co. Ltd.
Hamlyn House, Highgate Hill, London N19 5PP (01-272 0233) Telex 263206.
Easily maintained precipitators. Specially designed for gas cleaning, in power stations, cement works, refuse disposal installations, etc. Efficiency up to 99·99% obtained. "Industrap" modular unit also available for smaller applications.

FUEL ADDITIVES

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871) (*Alumag etc.*)

The Rolfite Company
U.K. Representatve: Cyril G. Henson, 'Overmead', Blackberry Road, Lingfield, Surrey RH7 6NQ (Dormans Park 297).
Rolfite products are based on a patented oil-soluble nitrogenous manganese complex, including solutions and dispersions. They are designed to condition oil for more uniform atomisation, improve combustion and reduce air pollution by combustion catalyst.

FUEL-ELECTRICITY SUPPLY

The Electricity Council
30 Millbank, London SW1P 4RD (01-834 2333).
Marketing Dept: Trafalgar Buildings, 1 Charing Cross, London SW1A 2OS (01-930 6757).
The Council is the central body for the electricity supply industry in England and Wales, responsible for consultation on and formulation of general policy.

FUEL OIL COMBUSTION IMPROVER

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
Manganese/Amine.

FUEL OIL CONDITIONER

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
Manganese/Amine.

FUELS (SOLID SMOKELESS)

Coalite & Chemical Products Ltd.
P.O. Box No. 21, Chesterfield, Derbyshire.

National Carbonising Company Limited
Fullarton Lodge, Crow Hill Drive, Mansfield, Notts (Mansfield 22644).

National Carbonising Company is the parent company of N.C.C. (Rexco) Ltd., manufacturers of Rexco smokeless fuels — Rexco Multi-Purpose, Rexco Nuts, Rexco Superbrite (Rexcobrite in Scotland), Rexco Ovoids and Rexco Blend with plants in Nottinghamshire, Leicestershire and at Comrie in Scotland. Also N.C.C. (Coke) Ltd., manufacturers of blast furnace and industrial cokes and domestic Rexcoke, with plants at Barnsley and Rotherham.

FUME REMOVAL EQUIPMENT

AAF Ltd.
Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

A.P.V.-Kestner Ltd.
Greenhithe, Kent DA9 9NG (Greenhithe 2253 or 3281).
The A.P.V.-Kestner Company produce thermo-setting, acid resisting plastics Keebush and Keeglas. Among many items manufactured from these materials are tanks, vertical glandless and horizontal pumps, gas washers, neutralisers, ducting, pipes, valves and fittings.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Centri-Spray International
Green Dragon House, 64/70 High Street, Croydon, CR9 1LG, Surrey (01-688-7431). Telex 261251.

Centri-Spray S.A.R.L.
3/5 Rue Talma, 75016 Paris, France.

Centri-Spray International GmbH
5159 Tuernich/Koeln, Fichten Str. 15, Germany.

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham B12 0LP (021-772-5102/3).
Dashwood Avenue, High Wycombe HP12 3DP, Bucks. (High Wycombe 22744).

Head Wrightson Process Engineering Ltd.
London Projects Office: 16/22 Baltic Street, London EC1Y 0TD (01-253 1299) Cables: Processes, London EC1.
A complete range of equipment is available to meet every kind of fume removal problem. Experience combined with extensive research and development facilities makes it possible to produce "tailor made" systems to meet individual needs.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.

Plastic
CONSTRUCTIONS
GROUP

The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tank, tank linings, pipes and pipelines.

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121) Telex 55201.
Spencer & Halstead, specialists in air pollution control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems, and a full filter media service.

Sturtevant Engineering Co. Ltd.
Hamlyn House, Highgate Hill, London N19 5PP (01-272 0233) Telex 263206.
Easily maintained precipitators. Specially designed for gas cleaning, in power stations, cement works, refuse disposal installations, etc. Efficiency up to 99·99% obtained. "Industrap" modular unit also available for smaller applications.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire WA14 5EP (061-928 4242).
(Air Pollution Control Engineers).
Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

FURNACES, KILNS, OVENS, ETC.

Auto Combustions (London) Ltd.
360/364 Wandsworth Road, London SW8 4TF (01-622 9121) Telex: Swirlamiser Chamcom/London 888941.
Manufacturers of Swirlamiser oil and gas burners and dual fuel oil/gas high velocity burners and Autoflame oil burners for process heating and all other purposes, furnaces, ovens, heaters, heat exchangers, boilers, water/oil emulsion firing.

R. M. Catterson-Smith Ltd.
Woodrolfe Road, Tollesbury, Essex (Tollesbury 342).
Electric resistance furnaces (450°C to 1750°C) in standard styles and sizes and also 'specials' to meet individual requirements for pottery, glass annealing and decoration, stained glass, enamelling, laboratory processes, wire annealing, heat treatment etc.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

GAS CLEANING PLANT

AAF Ltd.
Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).
International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

A.P.V.-Kestner Ltd.
Greenhithe, Kent DA9 9NG (Greenhithe 2253 or 3281).
The A.P.V.-Kestner Company produce thermo-setting, acid resisting plastics Keebush and Keeglas. Among many items manufactured from these materials are tanks, vertical glandless and horizontal pumps, gas washers, neutralisers, ducting, pipes, valves and fittings.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Centri-Spray International
Green Dragon House, 64/70 High Street, Croydon, CR9 1LG, Surrey (01-688-7431). Telex 261251.

Centri-Spray S.A.R.L.
3/5 Rue Talma, 75016 Paris, France.

Centri-Spray International GmbH
5159 Tuernich/Koeln, Fichten Str. 15, Germany.

Head Wrightson Process Engineering Ltd.
London Projects Office: 16/22 Baltic Street, London EC1Y 0TD (01-253 1299) Cables: Processes, London EC1.
Head Wrightson have supplied gas cleaning equipment to industry for nearly 30 years and provide "tailor made" systems incorporating electrostatic and wet tube precipitators, blockage proof flooded disc scrubbers, cyclones and fabric filters.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Sturtevant Engineering Co. Ltd.
Hamlyn House, Highgate Hill, London N19 5PP (01-272 0233) Telex 263206.
Easily maintained precipitators. Specially designed for gas cleaning, in power stations, cement works, refuse disposal installations, etc. Efficiency up to 99·99% obtained. "Industrap" modular unit also available for smaller applications.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire WA14 5EP (061-928 4242).
(Air Pollution Control Engineers).
Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

GAS H_2S

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts, SG1 2DE (Stevenage 3101-5) Telex 82385.
Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ—500μ), Radio Active Particle Measuring Equipment and H_2S Gas Monitors (10ppm Alarm Level).

GAS HEATING EQUIPMENT (BUTANE/PROPANE)

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA (01-733 1181).

GAS SCRUBBERS & WASHERS

Aeronca International Ltd
Penarth Road Cardiff CF1 7UG (Cardiff 387873).
Berkshire House, Maidenhead, Berkshire (Maidenhead 30311).

A.P.V.-Kestner Ltd.
Greenhithe, Kent DA9 9NG (Greenhithe 2253 or 3281).
The A.P.V.-Kestner Company produce thermo-setting, acid resisting plastics Keebush and Keeglas. Among many items manufactured from these materials are tanks, vertical glandless and horizontal pumps, gas washers, neutralisers, ducting, pipes, valves and fittings.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Collectron (Dust Control) Ltd.
5 Greenhills Road, Charlton Kings, Cheltenham, Gloucestershire GL53 9ED (Cheltenham 56355).

Head Wrightson Process Engineering Ltd.
London Projects Office: 16/22 Baltic Street, London EC1Y 0TD (01-253 1299) Cables: Processes, London EC1.
Head Wrightson supply "tailor made" scrubber and washer systems. The company provides a complete range of this equipment including electrostatic and wet tube precipitators, blockage proof flooded disc scrubbers, cyclones and fabric filters.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

GAS UNIT HEATERS

Wilkins & Mitchell Ltd.
"The Hollies," Hollies Drive, Wednesbury, Staffordshire (021-556-1191) Telex 338337.
"Servisaire" Compact, wall-mounted balanced flue gas heater. Fans assist combustion and expel warm air from lower grille, just above floor level. Completely fail-safe. One simple control. Controllable from clocks and/or thermostats. Fully guaranteed.

GRIT ARRESTERS

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236-3388).
Gas Cleaning and Dust Collection Plant and Services.

Sturtevant Engineering Co. Ltd.
Hamlyn House, Highgate Hill, London N19 5PP (01-272 0233) Telex 263206.
Easily maintained precipitators. Specially designed for gas cleaning, in power stations, cement works, refuse disposal installations, etc. Efficiency up to 99·99% obtained. "Industrap" modular unit also available for smaller applications.

HEAT EXCHANGERS

Auto Combustions (London) Ltd.
360/364 Wandsworth Road, London SW8 4TF (01-622 9121) Telex: Swirlamiser Chamcom/London 888941.
Manufacturers of Swirlamiser oil and gas burners and dual fuel oil/gas high velocity burners and Autoflame oil burners for process heating and all other purposes, furnaces, ovens, heaters, heat exchangers, boilers, water/oil emulsion firing.

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Howden Engineering Ltd.
Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
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HEATERS, AIR

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

HEATERS—INFRA RED

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA (01-733 1181).
Nor-Ray-Vac suspended, gas fired, infra-red radiant heating system for industrial and commercial buildings features: High standard human comfort, ease of installation, frees all floor space, avoids condensation problems and gives 92% fuel efficiency.

HEATING EQUIPMENT, INDUSTRIAL (PROCESS SPACE)

Carrier Engineering Company Ltd.

Carrier House, Warwick Row, London SW1E 5EL (01-834 6858) Telex 23581. Air Conditioning Division, York Towers, York Road, Leeds LS9 6TP (0532-40061).
The Air Conditioning Division of Carrier Engineering Company design and install air conditioning, electrical and mechanical services for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised applications.

HUMIDIFIERS

Felvic Industries

21 Napier Road, Bromley, BR2 9JA, Kent (01-464 6515) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

INCANDESCENT/WHITING WET ARRESTERS FOR CUPOLAS

Wellman Incandescent Limited

Cornwall Road, Smethwick, Warley B66 2LB (021-558 3151).

INCINERATORS

Babcock & Wilcox Ltd.

165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

The Incinerator Company Ltd.

Howard Road, Eaton Socon, St. Neots, Hunts PE19 3ER. (Eaton Socon 8171).
Incinerators for all industrial, chemical and municipal wastes, cremators for animal wastes, after burning units for furnaces of all types.

Johnson Matthey Chemicals Ltd.

74 Hatton Garden, EC1P 1AE (01-405 6989).
Abatement of odours or organic content of air/steam by means of Honeycat$^{(R)}$ *air pollution control catalytic incineration.*

Peabody Ltd.

17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

G. F. Rider (Process Plant) Ltd.

Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

Victor Products (Wallsend) Ltd.

P.O. Box Wallsend, Northumberland NE28 6PP (Wallsend 628331).
50 Pall Mall, London, S.W.1 (01-930-7142).
Bridge Mill, Bridge Street, Mansfield, Notts. (Mansfield 32365).
(*Victor Incinerators*).

Wellman Incandescent Limited.

Cornwall Road, Smethwick, Warley, B66 2LB, Worcs. (021-558-3151).

John Zink Company Ltd.

Acrewood Way, St. Albans, Herts. (St. Albans 61451) Telex 265930. Cables: Jonzin, St. Albans.

INSTRUMENTS, GAUGES, METERS, ETC.

Babcock & Wilcox Ltd.

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Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Felvic Industries

21 Napier Road, Bromley, BR2 9JA, Kent (01-464 6515) Telex: 896501.
Humidity and Temperature Control; Air Conditioning; Anti Pollution and Environmental Control; Free consultancy and design service on industrial, commercial and domestic applications.

LABORATORY FUME CABINETS

Plastic Constructions Ltd.

Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

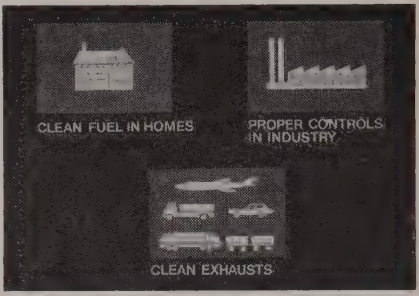
W.H.S. (Pathfinder) Ltd.

Solent Road, Havant, Hampshire PO9 1JF (Havant 3661/4).
W.H.S. (Pathfinder) Ltd., manufacturers of Laminar Flow Clean air Cabinets and Modules, Fume Cabinets and associated fans and ducting, Close-control Air Conditioning equipment ('Climaticaire') Patient Isolators ('Sterair') and supply 'Climet' are pollutions measurement equipment, 'D & L' dehumidifiers, air filters, as well as offering a complete design and installation service for Clean Rooms and air conditioning installations for comfort and specialist applications.

LECTURE, FILMSTRIPS & NOTES

Diana Wyllie Ltd.

3 Park Road, Baker Street, London N.W.1 (01-723-7333/3330).



"The Air You Breathe" with notes by Rear Admiral P. G. Sharp, Director of the National Society for Clean Air; "Air Pollution" Parts 1 & 2 by Professor R. S. Scorer; "Water Pollution" Parts 1 & 2 by J. Ian Waddington.

ODOUR CONTROL

Howden Engineering Ltd.

Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex, TW13 6DQ (01-898-5911) Telex: 24692; Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429-2131) Telex: 77439; Telegrams Howden Glasgow.
14/16 Cockspur Street, London S.W.1. (01-930-1353) Telegrams: Preheating London.
"Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd., is especially interested in the engineering of Inert Gas Systems, Air Pollution Control, Desalination Plants, Control of Effluents, Sewage Treatment; backed up by Howden expertise in Air/Gas Handling, Hydraulics etc."

Izal Ltd.

Thorncliffe, Chapeltown, Sheffield, S30 4YP (0741-5-3171).
Airkem (U.S.A.) odour control equipment and products for industrial plant, sewage works, crematoria, hospitals, washrooms etc., are distributed in the U.K. by Izal. The range also includes disinfectants and detergent cleansers with odour counteractant properties. Airkem odour counteractants attack mal-odour molecules in the atmosphere and the interaction of the two result in the reduction of the offensive odour to an acceptable level, both quickly and economically. List of products manufactured by Airkem: Cavalier Solidaire Gels; Sentinel; Sentinel V; Guardian; Guardian 2; Musketeers; Cavalier 2; On Guard; Airkem Wick Bottles and Chloroblocs.

Peabody Ltd.

17-27 Garratt Lane, London SW18 4BY (01-874-6491). Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Sylfair Ltd.

Balfour Road, Weybridge, Surrey (Weybridge 44902).
'Sylfair' and 'Banoda' portable air circulators and cleaners requiring simple yearly filter change.

POLLUTION CONTROL ADVISORY SERVICES

The British Non-Ferrous Metals Research Association
Grove Laboratories, Denchworth Road, Wantage, Berkshire OX12 9BJ (02357-2992) Telex 837166.
The Association studies the air pollution problems of the metal manufacturing industries and provides to members and non-members consultancy services and fume monitoring facilities in connection with all aspects of metal melting and processing.

PUMPS

A.P.V.-Kestner Ltd.
Greenhithe, Kent DA9 9NG (Greenhithe 2253 or 3281).
The A.P.V.-Kestner Company produce thermo-setting, acid resisting plastics Keebush and Keeglas. Among many items manufactured from these materials are tanks, vertical glandless and horizontal pumps, gas washers, neutralisers, ducting, pipes, valves and fittings.

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Weybridge Surrey KT14 7PB (Byfleet 43224/5). Telegrams: Capumps Byfleet. Telex 928368.
Charles Austen Pumps Ltd., manufacture a range of "oil free" diaphragm pumps suitable for continuous operation for sampling CO_2, SO_2 furnace gases, sulphur fumes etc., the range covers flow rates from 0 *to* 70 *litres per minute.*

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

RADIANT HEATING

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA (01-733 1181).

REFRIGERATION PLANT

M.L. Industrial Products Ltd.
Refrigeration Division, 292 Leigh Road, Trading Estate, Slough, Buckinghamshire (Slough 23838) (*Suppliers of Refrigeration Equipment*).

RESEARCH AND DEVELOPMENT FACILITIES

The British Non-Ferrous Metals Research Association.
Grove Laboratories, Denchworth Road, Wantage, Berkshire OX12 9BJ (02357-2992) Telex 837166.
The Association studies the air pollution problems of the metal manufacturing industries and provides to members and non-members consultancy services and fume monitoring facilities in connection with all aspects of metal melting and processing.

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London SW1E 5EL (01-834 6858) Telex 23581. Air Conditioning Division, York Towers, York Road, Leeds LS9 6TP (0532-40061).
The Air Conditioning Division of Carrier Engineering Company design and install air conditioning, electrical and mechanical services for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised applications.

Electrical Research Association (ERA)
Cleeve Road, Leatherhead, Surrey (Leatherhead 74151).

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791) Cables: Teesdale, Stockton on Tees.
16/22 Baltic Street, London, EC1Y 0TD (01-253 1299) Cables: Processes, London E.C.1.
Head Wrightson have a sophisticated Research and Development Division focused on mechanical and chemical engineering. This division, assists the member companies of the Head Wrightson Group and provides a number of consultancy services to outside companies.

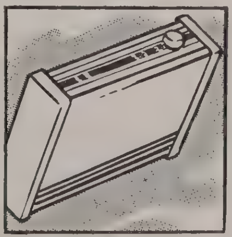
Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ (021-236 3388).
Gas Cleaning and Dust Collection Plant and Services.

ROOF VENTILATORS (PVC)

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
Trade Name: Placon. The Plastic Construction Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

ROOM HEATERS—GAS

Parkinson Cowan Appliances Ltd.
Stechford, Birmingham B33 9AD (021-783 4000). Telex 338068. Telegrams Appliance Birmingham.



Trade Name: Rapide (gas warm air unit heater). Parkinson Cowan Rapide. 10,000 *BtU output, room-sealed gas warm air heater. Forced convection gives rapid heat output, even room temperature (pre-selected by built-in thermostat). Weighs 27 lbs., measures* 18*in.* x 20.75*in.* x 5.25*in. Quiet running, quickly installed.*

SCRUBBERS

A.P.V.-Kestner Ltd.
Greenhithe, Kent DA9 9NG (Greenhithe 2253 or 3281).
The A.P.V.-Kestner Company produce thermo-setting, acid resisting plastics Keebush and Keeglas. Among many items manufactured from these materials are tanks, vertical glandless and horizontal pumps, gas washers, neutralisers, ducting, pipes, valve and fittings.

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Godfrey House, Hampton Road West, Hanworth, Feltham, Middlesex TW13 6DQ (01-898 5911) Telex 24692. Telegrams: Godfrepart London.
195 Scotland Street, Glasgow G5 8PJ (041-429 2131) Telex 77439. Telegrams: Howden Glasgow.
14/16 Cockspur Street, London SW1 (01-930 1353). Telegrams: Preheating London.
Howden Engineering Ltd. as the contracting organisation with the Howden Group Ltd. is especially interested in the engineering of inert gas systems, air pollution control, desalination plants, control of effluents, sewage treatment; backed up by Howden expertise in air/gas handling, hydraulics, etc.

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Peabody Ltd.
17-27 Garratt Lane, London SW18 4BY (01-874 6491) Telex 928632.
Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

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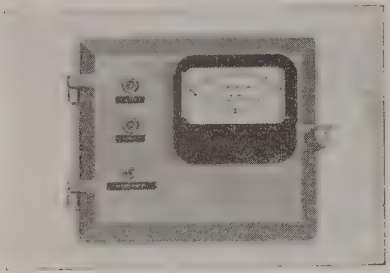
SLEEVES & TUBES (FOR FABRIC FILTERS)

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

SMOKE DENSITY GAUGES & METERS

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).



A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

SMOKE INDICATORS

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. (0494-25252).

Photoelectronics (Arcall) Ltd.
Arcall House, Restmor Way, Hackbridge, Wallington, Surrey (01-669-0966-7-8).
A comprehensive range of Smoke Density and Air Monitoring Equipment are available from Photoelectronics (Arcall) Ltd., and all Units can be provided with the unique Everclean Windows. Versions for Shipboard are also available.

Ronald Trist Controls Ltd.
Bath Road, Slough, Bucks. (Slough 34646) (*Electricon Smoke Density Indicators and Alarms*).

SMUT INHIBITORS

Combustion Chemicals Ltd.
Burwood Works, Chertsey, Surrey (Chertsey 63871).
(Flue and flue gas treatments); Alumag fuel additive.

STOKERS, INDUSTRIAL

Babcock & Wilcox Ltd.
165 Great Dover Street, London, SE1 4YB (01-407-8383).
Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

TANKS & TANK LININGS

Durapipe & Lamberts Sales Ltd.
Norton Canes, Cannock, Staffs., WS11 3NS (Heath Hayes 79909) Telex: 339745.
Lewisham Road, Slaithwaite, Yorkshire (Slaithwaite 2398).
Novers Hill Trading Estate, Bedminster, Bristol BS3 5QY (Bristol 668169).
The Industrial Plastics Centre, Tyne Tunnel Trading Estate, North Shields, Northumberland (North Shields 78125).

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves scrubbing towers, tanks, tank linings, pipes and pipelines.

THERMAL STORAGE SYSTEMS

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London SW1E 5EL (01-834 6858) Telex 23581.
Air Conditioning Division, York Towers, York Road, Leeds LS9 6TP (0532-40061).

The Air Conditioning Division of Carrier Engineering Company design and install air conditioning, electrical and mechanical services for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised applications.

TOWERS

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
The Plastic Constructions Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves scrubbing towers, tanks, tank linings, pipes and pipelines.

UNIT DUST COLLECTORS

AAF Ltd.
Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF (Cramlington 3477).

International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. (021-236-5391).

Dust Control Equipment Ltd.
Thurmaston, Leicester LE4 8HP (Syston (053-723) 3333).
Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG (Leicester 766316/7/8).

Spencer & Halstead Ltd.
Ossett, Yorkshire, WF5 9AW (Ossett 5121). Telex: 55201.
Spencer & Halstead, specialists in air pollution control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems, and a full filter media service.

Sylfair Ltd.
Balfour Road, Weybridge, Surrey (Weybridge 44902).
'Sylfair' and 'Banoda' portable air circulators and cleaners requiring simple yearly filter change.

VACUUM CLEANING

Bivac Air Company Ltd.
Marsland Street, Stockport (061-480 3468).
Designers and manufacturers of ring main vacuum cleaning systems and portable vacuum cleaning plants.

VENTILATORS

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP (021-773 1331, 10 lines) Telex 338752.
Trade Name: Placon. The Plastic Construction Group design, manufacture and install in acid proof corrosion resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

WARM AIR HEATING SYSTEMS

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex, HA2 0DY (01-864-0288).
Devonshire House, High Street, Deritend, Birmingham B12 0LP. (021-772-5102/3).
Dashwood Avenue, High Wycombe HP12 3DP, Bucks. (High Wycombe 22744).

WASTE FUEL BOILER PLANT

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington Park, London N4 3RG (01-272-0404/5/6).
Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

WASTE HEAT RECOVERY

Babcock & Wilcox Ltd.
165 Great Dover Street, London,
SE1 4YB (01-407-8383).

Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Carrier Engineering Company Ltd.
Carrier House, Warwick Row, London
SW1E 5EL (01-834 6858) Telex 23581.
Air Conditioning Division, York
Towers, York Road, Leeds LS9 6TP
(0532-40061).

The Air Conditioning Division of Carrier Engineering Company design and install air conditioning, electrical and mechanical services for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised applications.

Head Wrightson Process Engineering Ltd.
PO Box 101, Stockton on Tees, Teesside TS17 6AZ (0642-69791). Cables:
Teesdale, Stockton on Tees.
16/22 Baltic Street, London EC1Y
0TD (01-253 1299). Cables: Processes,
London EC1.

Head Wrightson design waste heat recovery systems for a variety of industries and uses. One example is the large district heating scheme incorporated by Head Wrightson in the new Nottingham municipal incinerator.

Peabody Ltd.
17-27 Garratt Lane, London SW18
4BY (01-874 6491). Telex 928632.

Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington
Park, London N4 3RG (01-272
0404/5/6).

Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

WASTE MATERIAL DISPOSAL FURNACES

The Incinerator Company Ltd.
Howard Road, Eaton Socon, St.
Neots, Hunts PE19 3ER. (Eaton Socon
8171).

Incinerators for all industrial, chemical and municipal wastes, cremators for animal wastes, after burning units for furnaces of all types.
WA14 5EP (061-928 4242).

Peabody Ltd.
17-27 Garratt Lane, London SW18
4BY (01-874 6491). Telex 928632.

Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, 59/61 Tollington
Park, London N4 3RG (01-272
0404/5/6).

Comprehensive waste fired boiler plant, having optional summertime incineration, standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

John Zink Company Ltd.
Acrewood Way, St. Albans, Herts
(St. Albans 61451). Telex 265930.
Cables: Jonzin, St. Albans.

WET ARRESTERS

Buell Ltd.
George Street Parade, Birmingham
B3 1QQ (021-236 5391).

Collectron (Dust Control) Ltd.
5 Greenhills Road, Charlton Kings,
Cheltenham, Gloucestershire GL53
9ED (Cheltenham 56355).

Dust Control Equipment Ltd.
Thurmaston, Leicester LE4 8HP
(Syston (053-723) 3333).

Dust Control Equipment for Industry: Drytex dust control units; Autodrytex dust control units; Unimaster dust control units; Minimaster dust control units; Multiswirl wet dedusters; Drytube dust filters; Dalamatic automatic dust filters; Typhoon cyclonic dust separators.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham
B3 1QQ (021-236 3388).

Gas Cleaning and Dust Collection Plant and Services.

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG
(Leicester 766316/7/8).

Peabody Ltd.
17-27 Garratt Lane, London SW18
4BY (01-874 6491) Telex 928632.

Chemical and Combustion Engineers: Specialists in the supply of equipment for pollution control and fuel firing equipment for steam raising boilers.

Spencer & Halstead Ltd.
Ossett, Yorkshire WF5 9AW (Ossett
5121). Telex 55201.

Spencer & Halstead, specialists in air pollution control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems, and a full filter media service.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire
WA14 5EP (061-928 4242).
(Air Pollution Control Engineers).

Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems, filter tubes and screens.

Section 6

NATIONAL SOCIETY FOR CLEAN AIR

134/137 North Street, Brighton BN1 1RG

Telephone: Brighton 26313

Honorary Officers

President: H. B. Greenborough.

Immediate Past President: Stanley E. Cohen, C.B.E., C.C., F.R.S.A.

Hon. Treasurer: W. C. Turner, M.D., D.P.H., D.I.H.

Chairman of Council: W. Combey, D.P.A., F.A.P.H.I., F.R.S.H.

Deputy Chairmen: Miss M. George, M.B.E.
J. Clancey, B.E.M.

Immediate Past Chairman: S. Cayton, M.B.E., C.Eng., M.Inst.F.

Hon. Solicitors: Messrs. Wedlake Bell.

Hon. Auditors: Messrs. Geo. Little, Sebire & Co.

Executive Council

Elected Divisional Representatives:

Scotland: J. H. Christie, J. R. McGhie, I. W. Wintour.

Northern Ireland: J. R. Lamont.

North West: T. Baxter, H. Clusky, L. Goodman, R. A. W. Hollingdale, Cllr. E. J. Holt, W. E. Pollitt, A. G. Ward.

North East: L. Mair, Cllr. T. P. S. Prudham, Ald. B. N. Young.

Yorkshire: L. Eastwood, A. W. Perry, W. B. Twyford, J. H. Wyatt.

West Midlands: S. Cayton, J. Holston, W. L. Kay.

East Midlands: Cllr. Mrs. D. Ashley, Ald. A. L. Robinson, T. Henry Turner.

South West: D. J. Barnett, P. Draper.

South East: J. Clancey, W. Combey, A. G. O'Gilvie, Prof. R. S. Scorer, R. F. Shapter, G. C. Stubbs, E. W. Ward, Mrs. M. E. Willison, K. J. Winton.

South Wales and Monmouthshire:
W. Bate, Ald. J. H. Warren.

Appointed Representatives of National Bodies:
Asbestos Information Committee: A. A. Cross.
Association of Public Health Inspectors: T. H. Iddison.
British Medical Associaton: Dr. W. C. Turner.
British Steel Corporation: G. E. Speight.
Central Electricity Generating Board: A. J. Clarke.
Electrical Association for Women: Miss M. George.
Electricity Council: R. H. Phillips.
E.P.E.M.A.: M. Beaumont.
Gas Corporation: T. A. Dick.
Industrial Gas Cleaning Association: K. H. Pearson.
Institute of Fuel: B. Lees.
Institute of Petroleum: H. I. Fuller.
Institution of Gas Engineers: Dr. F. A. Burden.
Low Temperature Coal Distillers' Association: R. Pane.
National Coal Board: R. W. C. Wheatley.
Royal Society of Health: E. N. Wakelin.
Solid Smokeless Fuels Federation: H. Giblin.
Women's Solid Fuel Council: Mrs. J. Saunders.
Women's Gas Federation and Young Homemakers: Mrs. C. Gimpel.

Director and Secretary: Rear Admiral P. G. Sharp, C.B., D.S.C.

Divisional Councils

Scotland: President: Cllr. Mrs. Rina T. Nealon; Hon. Secretary: F. J. Feeley, Town Clerk's Office, 78 Cochrane Street, Glasgow. (041-221 9600, ext. 2538).

Northern Ireland: Chairman: R. Campbell Brown; Hon. Secretary: J. R. Lamont, 20 Kensington Gardens, Belfast BT5 6NP.

North West: Chairman: L. Goodman; Hon. Secretary: W. E. Pollitt, Health Centre, Crescent, Salford (061-736 5891).

North East: Chairman: Ald. B. N. Young; Hon. Secretary: L. Mair, Civic Centre, Barras Bridge, Newcastle-upon-Tyne. (Newcastle-upon-Tyne 28520).

Yorkshire: Chairman: L. Eastwood; Hon. Secretary: J. H. Wyatt, Health Dept., 12 Market Buildings, Vicar Lane, Leeds 1. (Leeds 30211, ext. 59).

East Midlands: Chairman: Ald. A. L. Robinson; Hon. Secretary: E. F. Raven, Public Health Department, County Borough of Derby, Castlefields House, Main Centre, Derby DE1 2FL. (Derby 31111).

West Midlands: Chairman: Cllr. H. N. Scrimshaw; Acting Secretary: S. Cayton, P.O. Box No. 47, Town Hall, Lombard Street West, West Bromwich.

South East: Chairman: W. Combey; Hon. Secretary: R. F. Shapter, Public Health Dept., 8 Easton Street, High Wycombe. (High Wycombe 26100).

South West: Chairman: Ald. C. Hebblethwaite; Hon. Secretary: D. J. Barnett, Chief Public Health Inspectors' Office, Union House, Union Street, Bristol BS1 (0272 26241).

South Wales and Monmouthshire: Chairman: Cllr. Mrs. P. M. Mainwaring; Hon. Secretary: L. Morgan, 9 Lodge Drive, Baglan, Port Talbot. (Port Talbot 5231).

Information about the Society

The forerunners of the Society were the Coal Smoke Abatement Society, established in London in 1899, the Smoke Abatement League of Great Britain (1909) concerned mainly with the Provinces and the National Smoke Abatement Society, formed in 1929 by the amalgamation of the two parent organisations. At a Special General Meeting held in April 1957, it was agreed unanimously to change the name of the Society to "National Society for Clean Air", and to seek incorporation as a company limited by guarantee, a licence being sought from the Board of Trade to omit the word limited. The Society assumed its new name and status on 1st January, 1958.

Divisions

For administrative and electoral purposes the Society is composed of geographical areas called ' Divisions '.

Membership

The Society is wholly dependent on the contributions of its members for the growth and the maintenance of its work, and invites the support of all who sympathise with and wish to promote its objects. These are stated in full in the Memorandum of Association, but they may be briefly summarised as the securing throughout the United Kingdom of the maximum of natural light and air free from every form of pollution, particularly that arising from the combustion of fuel. There are three main classes of membership—for individuals, local authorities, and corporate bodies such as firms, public undertakings and institutions. Individual members and the representatives of other members have rights of nomination and voting in elections for Officers and Council. They receive, free of charge, the Society's quarterly journal *Clean Air* and other publications.

Corporate members who have branches or offices in Divisions of the Society other than that in which their Registered Office is situated may appoint Delegates to participate in the activities of those Divisions. Members are entitled to receive assistance and information on problems relating to air pollution. In addition to receiving notices of meetings and conferences organised nationally, they are entitled to participate in any activities organised by or within their Division. The Society's Subscription year is for the period 1st April to 31st March.

Subscriptions

Individual Members—Not less than three pounds.

Local Authority Members—Subscriptions for Local Authority Members are based on the population which is taken from the current edition of the Municipal Year Book.

Corporate Members—The subscriptions for Corporate Members are based upon the size of the organisation.

Sustaining Members—A member in any class subscribing not less than £100 a year.

Special Cases—The Executive Council may consider applications for membership on special terms as to subscriptions and otherwise. This rule is intended to apply in particular to local and other small voluntary associations wishing to become Corporate Members.

Payment of Subscriptions—The first subscription should be forwarded with application for membership. This may be sent at any time, but will commence from 1st April, and back issues of *Clean Air* will be sent to new members.

Donations—The Society will be pleased to receive single or annual donations for any amount from non-members.

For further information about membership, subscriptions, Executive Council and Committees, etc. reference should be made to the Society's Memorandum and Articles of Association and Byelaws.

Membership as at 1st October 1973

SCOTTISH DIVISION

Sustaining Members

	£—p
South of Scotland Electricity Board	100.00
The Scottish Gas Board	150.00

Local Authority Members

	£—p
Aberdeen Cpn.	40.00
Airdrie Cpn.	13.00
Ayr Cpn.	13.00
Ayr C.C.	10.00
Barrhead, Burgh of	10.00
Clackmannan C.C.	13.00
Clydebank Cpn.	15.75
Coatbridge Cpn.	17.00
Dumbarton Cpn.	13.00
Dumfries Cpn.	13.00
Dunbarton C.C.	23.00
Dundee Cpn.	40.00
Dunfermline Cpn.	17.00
East Kilbride Cpn.	17.00
Edinburgh Cpn.	50.00
Falkirk Cpn.	13.00
Fife C.C.	35.00
Glasgow Cpn.	65.00
Grangemouth Cpn.	10.00
Hamilton, Burgh of	13.00
Hawick, Burgh of	10.00
Inverness Cpn.	13.00
Inverness C.C.	17.00
Irvine, Royal Burgh of	10.00
Johnstone Cpn.	10.00
Kilmarnock, Burgh of	13.00
Kilsyth, Burgh of	10.00
Kircaldy, Royal Burgh of	17.00
Kirkintilloch, Burgh of	13.00
Lanark C.C.	50.00
Motherwell & Wishaw, Burgh of	17.00
Paisley Cpn.	23.00
Perth C.C.	3.15
Perth Cpn.	13.00
Port Glasgow Cpn.	3.00
Renfrew C.C.	35.00
Renfrew, Royal Burgh of	10.00
Rothesay, Royal Burgh of	10.00
Rutherglen, Royal Burgh of	10.00
Stirling C.C.	23.00
Stirling, Royal Burgh of	13.00
West Lothian C.C.	35.00

Corporate Members

	£—p
British Steel Corporation (General Steels Division)	75.00
North of Scotland Hydro Electric Board	23.00
Scottish Rexco Ltd.	23.00
Smith & Wellstood Ltd.	3.00
Waldie and Cameron Ltd.	3.00

Individual Members

	£—p
Broadbent, J.	3.00
Christie, J. H.	3.00
Foreman, J.	3.00
Gibb, Dr. W.	3.00
Hally, J.	3.00
Horne, Dr. W. A.	2.10
Hoyle, J. D.	3.00
Innes, J.	3.00
MacPherson, I.	3.00
Moule, Rev. J. W.	3.00
Potter, G. N.	3.00
Ramsey, Captain E. C.	5.50
Slimming, D. W.	3.00
Snodgrass, G. A.	3.00
Strump, G.	3.00

NORTHERN IRELAND DIVISION

Local Authority Members

	£—p
Antrim C.C.	5.25
Antrim R.D.C.	13.00
Ballymena Cpn.	13.00
Belfast City	50.00
Carrickfergus Cpn.	10.00
Castlereagh R.D.C.	17.00
Londonderry Cpn.	17.00
Portadown Cpn.	10.00

Corporate Members

	£—p
Coal Advisory Service	23.00
Electricity Board for Northern Ireland	23.00

Individual Members

	£—p
Cave, S. A.	3.00
Dunbar, H.	3.00
Edwards, T. G.	3.00
Ellison, C. A.	3.00
Hanna, B.	3.00
Hinchliff, D.	3.00
Hood, N. R. S.	3.00
Jenkins, Major W.	3.00
Lamont, J. R.	3.00
Lynas, K. H.	3.00
Magee, J. L.	3.00
McAlery, Miss I. M. E.	1.50
Millar, J.	3.00
O'Brien, W. E. C.	3.00
Porter, Colonel H. J.	3.00
Reynolds, A.	3.00

NORTH-WEST DIVISION

Sustaining Members

	£—p
Mather & Platt Ltd.	100.00
North-Western Electricity Board	101.00
North-Western Gas Board	200.00
Shell Chemicals U.K. Ltd.	125.00
Simon Carves Ltd.	200.00

Local Authority Members

	£—p
Abram U.D.C.	10.00
Accrington Cpn.	13.00
Altrincham Cpn	13.00
Ashton-in-Makerfield U.D.C.	13.00
Ashton-under-Lyne Cpn.	13.00
Atherton U.D.C.	10.00
Audenshaw U.D.C.	10.00
Bacup Cpn.	10.00
Barrow-in-Furness Cpn.	17.00
Bebington Cpn.	17.00
Birkenhead Cpn.	35.00
Blackburn Cpn.	35.00
Blackpool Cpn.	35.00
Bolton Cpn.	35.00
Bootle Cpn.	12.60
Bredbury & Romiley U.D.C.	13.00
Brierfield U.D.C.	10.00
Bucklow R.D.C.	10.00
Burnley Cpn.	23.00
Burnley R.D.C.	10.00
Bury Cpn.	17.00
Buxton Cpn.	10.00
Chadderton U.D.C.	13.00
Cheadle & Gatley U.D.C.	17.00
Cheshire C.C.	65.00
Chester R.D.C.	13.00
Chorley Cpn.	13.00
Church U.D.C.	10.00
Clitheroe Cpn.	3.15
Colne Cpn.	10.00
Connah's Quay U.D.C.	10.00
Crewe Cpn.	17.00
Crompton U.D.C.	10.00
Crosby Cpn.	3.15
Cumberland C.C.	5.00
Darwen Cpn.	13.00
Denton U.D.C.	13.00
Droylsden U.D.C.	10.00
Dukinfield Cpn.	10.00
Eccles Cpn.	13.00
Ellesmere Port Cpn.	17.00
Failsworth U.D.C.	10.00
Farnworth Cpn.	13.00
Fleetwood Cpn.	13.00
Flint Cpn.	10.00
Fulwood U.D.C.	10.00
Glossop Cpn.	10.00
Golborne U.D.C.	13.00
Great Harwood U.D.C.	10.00
Hale U.D.C.	10.00
Haslingden Cpn.	10.00
Haydock U.D.C.	10.00
Hazel Grove & Bramhall U.D.C.	13.00
Heywood Cpn.	13.00
Hindley U.D.C.	10.00
Horwich U.D.C.	10.00
Hoylake U.D.C.	13.00
Huyton with Roby U.D.C.	17.00
Hyde Cpn.	13.00
Ince in Makerfield U.D.C.	10.00
Irlam U.D.C.	10.00
Kearsley U.D.C.	10.00
Kirkby U.D.C.	17.00
Lancashire C.C.	80.00
Lancaster Cpn.	13.00
Lees U.D.C.	10.00
Leigh Cpn.	13.00
Leyland U.D.C.	10.00
Littleborough U.D.C.	10.00
Liverpool Cpn.	65.00
Longdendale U.D.C.	10.00
Macclesfield Cpn.	13.00
Manchester Cpn.	65.00
Marple U.D.C.	10.00
Matlock U.D.C.	10.00
Middleton Cpn.	17.00
Middlewick U.D.C.	10.00
Mold U.D.C.	10.00
Morecambe & Heysham Cpn.	13.00
Nantwich U.D.C.	10.00
Nelson Cpn.	13.00
Newton le Willows U.D.C.	10.00
Northwich R.D.C.	10.00
Northwich U.D.C.	10.00
Oldham Cpn.	35.00
Ormskirk U.D.C.	13.00
Padiham U.D.C.	10.00
Preston Cpn.	23.00
Preston R.D.C.	17.00
Prestwich Cpn.	13.00
Radcliffe Cpn.	13.00
Ramsbottom U.D.C.	10.00
Rawtenstall Cpn.	10.00
Rhyl U.D.C.	10.00
Riston U.D.C.	10.00
Rochdale Cpn.	23.00
Royton U.D.C.	10.00
Runcorn R.D.C.	13.00
Runcorn U.D.C.	13.00
St. Helens Cpn.	35.00
Sale Cpn.	17.00
Salford Cpn.	35.00
Skelmersdale & Holland U.D.C.	13.00
Southport Cpn.	3.00
Stalybridge Cpn.	10.00
Standish with Langtree U.D.C.	10.00

	£—p
Stockport Cpn.	35.00
Stretford Cpn.	17.00
Swinton & Pendlebury Cpn.	13.00
Thornton Cleveleys U.D.C.	5.25
Tintwhistle R.D.C.	3.00
Tyldesley U.D.C.	10.00
Urmston U.D.C.	13.00
Wallasey Cpn.	23.00
Warrington Cpn.	17.00
Warrington R.D.C.	17.00
West Lancashire R.D.C.	17.00
Whiston R.D.C.	23.00
Whitefield U.D.C.	10.00
Whitworth U.D.C.	17.00
Widnes Cpn.	17.00
Wigan Cpn.	23.00
Wilmslow U.D.C.	13.00
Winsford U.D.C.	10.00
Workington Cpn.	13.00
Worsley U.D.C.	13.00
Wrexham Cpn.	13.00
Wrexham R.D.C.	17.00

Corporate Members

	£—p
Beatties Ltd. (P. D. Fuels)	3.00
Bibby & Sons	23.00
British Insulated Callender's Cables Ltd.	23.00
Coal Merchants Federation of Great Britain (N.W. Region)	30.00
Dean, W. H., Ltd.	3.00
Federation of Owner-Occupier's & Owner-Resident's Association Ltd.	3.00
Furness District Federation of Owner-Occupiers' Association	3.00
Lancashire & District Coke Distributors Association	30.00
Macclesfield Civic Society	3.00
Manchester and District Regional Clean Air Council	40.00
Mass Transfer Ltd.	23.00
Merseyside & North Wales Electricity Board	72.00
Nailsea Engineering Ltd.	23.00
Refuge Assurance Co. Ltd.	15.00
Robinson Willey Ltd.	40.00
South-East Lancashire & North Cheshire Consultative Committee for the Investigation of Atmospheric Pollution	3.00
Taymer Ltd.	3.00
Tillotsons Newspapers Ltd.	10.00

Individual Members

	£—p
Ault, H.	1.05
Barnes, W.	3.00
Baxter, T.	3.00
Bayers, Mrs. M.	3.00
Behrens, A.	3.00
Bibby, H. P.	3.00
Brown, P. S.	1.50
Bulcraig, Dr. W. R.	3.00
Cass, H. V.	3.00
Chandler, Prof. T. J.	3.00
Christian, F. V.	3.00
Clusky, H.	3.00
Cooper, R. I.	3.00
Dearden, Mr. & Mrs. J.	3.00
Forsyth, Mrs. J. A.	3.00
Franklin, E. J.	3.00
Franklin, N. J.	3.00
Gee, J.	3.00
Gee, Mrs. J.	3.00
Gibbons, E. B.	3.00
Graham, G. M.	3.00
Hall, A.	3.00
Hall, E. N.	3.00
Halliday, A. C.	3.00
Hallows, V. K.	3.00
Hayhurst, H.	3.00
Hayhurst, Mrs. K. M.	2.00
Heald, Dr. G. E.	1.05
Hendy, Dr. B.	3.00
Jackson, C. L.	3.00
Jewsbury, S.	3.00
Kirk, W. R.	3.00
Kitchener, The Rt. Hon., The Earl	1.00
Knight, R. F.	3.00
Lane, Mrs. W.	3.00
Leech, Dr. P. W.	3.00
Lees, Miss M.	3.00
Lloyd, A.	3.00
Mason, Mrs. E. M.	3.00
Mather, Sir William	3.00
Mess, H.	3.00
Moore, H.	3.00
Moss, D.	3.00
Pennington, H.	1.05
Pike, Miss I. M.	3.00
Poller, Mrs. H.	3.00
Pollitt, W. E.	3.00
Rae, K. F.	3.00
Renshaw, T.	3.00
Richards, J. E.	3.00
Roots, D. C.	3.00
Shaw, Mrs. M.	3.00
Smith, W.	3.00
Stanyard, R. J.	3.00
Stringer, F. W.	3.00
Taylor, A.	3.00
Taylor, Mrs. A. E.	3.00
Taylor, Mrs. E.	3.00
Taylor, S.	3.00
Thomas, F. L.	3.00
Topham, Mrs. D. A.	3.00
Vanstone, H. B.	3.00
Ward, A. G.	3.00
Warren, D.	3.00
Wilkinson, J. R.	3.00
Williamson, J. G.	3.00
Winder, F.	3.00
Wood, Mrs. C.	3.00

NORTH-EAST DIVISION

Sustaining Members

Northern Gas Board	100.00

Local Authority Members

Ashington U.D.C.	13.00
Barnard Castle R.D.C.	10.00
Bedlingtonshire U.D.C.	13.00
Bishop Auckland U.D.C.	13.00
Blaydon U.D.C.	13.00
Boldon U.D.C.	10.00
Brandon & Byshottles U.D.C.	10.00
Castle Ward R.D.C.	13.00
Chester-le-Street R.D.C.	13.00
Chester-le-Street U.D.C.	10.00
Consett U.D.C.	13.00
Crook & Willington U.D.C.	10.00
Darlington Cpn.	7.35
Durham R.D.C.	13.00
Felling U.D.C.	13.00
Gateshead Cpn.	23.00
Gosforth U.D.C.	13.00
Hartlepool Cpn.	23.00
Hebburn U.D.C.	10.00
Hetton U.D.C.	10.00
Houghton le Spring U.D.C.	13.00
Jarrow Cpn.	13.00
Lanchester R.D.C.	13.00
Longbenton U.D.C.	13.00
Newburn U.D.C.	13.00
Newcastle upon Tyne Cpn.	40.00
Northumberland C.C.	65.00
Prudhoe U.D.C.	10.00
Ryton U.D.C.	10.00
Seaham U.D.C.	10.00
Sedgefield R.D.C.	13.00
Shildon U.D.C.	10.00
Skelton & Brotton U.D.C.	10.00
South Shields Cpn.	35.00
Spennymoor U.D.C.	10.00
Stanley U.D.C.	13.00
Sunderland Cpn.	40.00
Teesside Cpn.	50.00
Tynemouth Cpn.	17.00
Wallsend Cpn.	13.00
Washington U.D.C.	10.00
Whickham U.D.C.	13.00
Whitley Bay Cpn.	13.00

Corporate Members

	£—p
American Air Filter (Great Britain) Ltd.	23.00
Coal Merchants' Federation of Great Britain (N.E. Region)	23.00
Head Wrightson & Co. Ltd.	23.00
Newcastle Regional Hospital Board	23.00
North-Eastern Electricity Board	60.00
Proctor & Gamble Ltd. (Engineering Division)	25.00
University of Newcastle upon Tyne	3.00

Individual Members

Angus, Col. E. G.	3.15
Atkinson, E.	3.00
Atkinson, H.	3.00
Blake, D.	3.00
Calvert, Mrs. M. R.	3.00
Carr, W.	3.00
Chambers, A.	3.00
Cooper, R. I.	3.00
Cosgrove, J.	3.00
Eve, M. E.	1.50
Horn, R.	3.00
Isaac, Professor, P. C. G.	3.00
Learmonth, G. S.	3.00
McMullen, A. J.	3.00
Spriggs, Dr. E. A.	3.00
Thomas, D. M. C.	3.00
Walker, A. S.	3.00

YORKSHIRE DIVISION

Sustaining Members

British Steel Corporation (Special Steels Division)	125.00
North Eastern Gas Board	100.00
Yorkshire Electricity Board	104.00

Local Authority Members

Adwick-le-Street U.D.C.	10.00
Aireborough U.D.C.	13.00
Barnsley Cpn.	23.00
Batley Cpn.	13.00
Bentley with Arksey U.D.C.	10.00
Bingley U.D.C.	13.00
Bradford Cpn.	45.00
Bridlington Cpn.	10.00
Brighouse Cpn.	13.00
Castleford Cpn.	13.00
Colne Valley U.D.C.	10.00
Conisbrough U.D.C.	10.00
Cudworth U.D.C.	10.00
Darton U.D.C.	10.00
Dearne U.D.C.	13.00
Denby Dale U.D.C.	10.00
Dewsbury C.B.	17.00
Doncaster C.B.	23.00
Doncaster R.D.C.	23.00
Elland U.D.C.	10.00
Halifax Cpn.	23.00
Harrogate Cpn.	17.00
Heckmondwike U.D.C.	10.00
Hemsworth R.D.C.	17.00
Hemsworth U.D.C.	10.00
Hepton R.D.C.	10.00
Holmfirth U.D.C.	10.00
Horbury U.D.C.	10.00
Horsforth U.D.C.	10.00
Hoyland Nether U.D.C.	10.00
Huddersfield Cpn.	35.00
Ilkley U.D.C.	10.00
Keighley Cpn.	3.00
Kingston-upon-Hull Cpn.	45.00
Knottingley U.D.C.	10.00
Leeds Cpn.	65.00
Meltham U.D.C.	10.00
Mexborough U.D.C.	10.00
Mirfield U.D.C.	10.00
Morley Cpn.	13.00
Normanton U.D.C.	10.00
North Riding of Yorkshire C.C.	45.00

	£—p
Ossett Cpn.	10.00
Otley U.D.C.	10.00
Pontefract Cpn.	13.00
Pudsey Cpn.	13.00
Queensbury & Shelf U.D.C.	10.00
Rawmarsh U.D.C.	10.00
Rotherham Cpn.	23.00
Rothwell U.D.C.	13.00
Royston U.D.C.	10.00
Scarborough Cpn.	13.00
Sheffield & District Clean Air Committee	65.00
Shipley U.D.C.	13.00
Skipton U.D.C.	10.00
Sowerby Bridge U.D.C.	3.00
Spenborough Cpn.	13.00
Stanley U.D.C.	10.00
Swinton U.D.C.	23.00
Thorne R.D.C.	13.00
Todmorden Cpn.	10.00
Wakefield Cpn.	17.00
Wakefield R.D.C.	10.00
Wath-upon-Dearne U.D.C.	10.00
Wombwell U.D.C.	10.00
Worsborough U.D.C.	10.00
Wortley R.D.C.	13.00
York Cpn.	5.25

Corporate Members

Barnsley District Coking Co. Ltd.	23.00
Bradford Civic Society	3.00
British Acheson Electrodes Ltd.	23.00
Coke Oven Managers' Association	6.00
John Thurley Ltd.	40.00
North Eastern Coke Distributors Association	18.00
Universal Machinery & Services Ltd.	15.75
West Riding Clean Air Advisory Council	6.00

Individual Members

Armitage, F.	3.00
Ball, J. D.	3.00
Bell, T. R. H.	3.00
Brett-Littlechild, R.	3.00
Brown, G. L.	3.00
Burn, Dr. A. T.	3.00
Crocker, P.	3.00
Etheringham, H.	1.05
Fleming, I.	3.00
Gower, Miss V. L.	3.00
Hackney, E. S.	3.00
Hafner, Dr. A. E.	3.00
Hutton, Dr. K. B.	10.00
Imrie, B. W.	3.00
Jones, L.	3.00
Jordon, H. H.	3.00
Laverick, P. M.	3.00
Marshall, G. C.	1.25
Miller, Dr. J. E.	4.05
Newell, R. A.	3.00
Saword, A. C.	3.00
Saxton, W. T.	3.00
Sedgwick, A.	3.00
Sewell, Dr. P.	3.00
Sharp, A. I.	3.00
Slater, D. J.	3.00
Tomlinson, E. S.	3.00
Winfield, E. J.	3.00

WEST MIDLANDS DIVISION

Sustaining Members

Courtaulds Ltd.	200.00
Midlands Electricity Board	107.00
West Midlands Gas Board	210.00

Local Authority Members

Aldridge-Brownhills U.D.C.	23.00
Atherstone R.D.C.	13.00
Bedworth U.D.C.	13.00
Birmingham Cpn.	65.00
Burton upon Trent Cpn.	17.00
Cannock R.D.C.	13.00
Cannock U.D.C.	17.00
Coventry Cpn.	45.00
Dudley Cpn.	40.00
Halesowen Cpn.	17.00
Hereford Cpn.	13.00
Kidderminster Cpn.	13.00
Leamington Spa Cpn.	13.00
Meriden R.D.C.	35.00
Newcastle-under-Lyme Cpn.	23.00
Nuneaton Cpn.	17.00
Redditch U.D.C.	13.00
Rugby Cpn.	17.00
Rugeley U.D.C.	10.00
Seisdon R.D.C.	3.00
Solihull Cpn.	35.00
Stafford Cpn.	17.00
Staffordshire C.C.	30.25
Stoke-on-Trent Cpn.	45.00
Stone R.D.C.	10.00
Sutton Coldfield Cpn.	23.00
Tamworth Cpn.	13.00
Walsall Cpn.	40.00
Warley Cpn.	35.00
Warwick R.D.C.	13.00
Warwick Cpn.	10.00
Warwickshire C.C.	18.90
Wellington (Salop) U.D.C.	10.00
West Bromwich Cpn.	35.00
Wolverhampton Cpn.	45.00
Worcester Cpn.	17.00

Corporate Members

Cradley Boiler Co. Ltd.	23.00
Guest, Keen & Nettlefolds Ltd.	50.00
Lodge Cottrell Limited	23.00
Midlands Joint Advisory Clean Air Council	12.00
Warwickshire Clean Air Council	40.00
University of Aston-in-Birmingham—Department of Building	23.00

Individual Members

Berry, R. J.	3.00
Busby, H. G. T.	3.00
Cockerham, Dr. R. G.	1.50
Darby, K.	3.00
Darnell, J. R.	1.50
Dickinson, S.	3.00
Dingley, W. L.	3.00
Donaldson, I. J.	3.00
Garner, N. A.	1.50
Gillet, J. A.	3.00
Gittins, M. J.	3.00
Grimmett, P. H. G.	1.50
Hockton, D.	3.00
Knightsbridge, C. R.	3.00
Longley, J. C.	3.00
Lowbridge, H. E. T.	3.00
Owen, A. G.	3.00
Reynolds, F.	3.00
Reynolds, K.	3.00
Roberts, R. E. J.	3.00
Scrimshaw, H. N.	3.00
Smart, R. C.	3.00
Steadman, A. T.	3.00
Taylor, Mr. & Mrs. C. B.	3.00

EAST MIDLANDS DIVISION

Sustaining Members

Coalite & Chemical Products Ltd.	500.00
Eastern Electricity Board	113.00
East Midlands Gas Board	200.00

Local Authority Members

Alfreton U.D.C.	10.00
Basford R.D.C.	17.00
Beeston & Stapleford U.D.C.	17.00
Belper R.D.C.	10.00
Belper U.D.C.	10.00
Bingham R.D.C.	13.00
Blaby R.D.C.	17.00
Blackwell R.D.C.	13.00
Bolsover U.D.C.	10.00
Boston Cpn.	10.00
Cambridge City	10.00
Carlton U.D.C.	13.00
Chesterfield Cpn.	17.00
Chesterfield R.D.C.	17.00
Clay Cross U.D.C.	10.00
Clowne R.D.C.	10.00
Coalville U.D.C.	13.00
Corby U.D.C.	13.00
Derby Cpn.	40.00
Dronfield U.D.C.	10.00
Eastwood U.D.C.	10.00
Gainsborough U.D.C.	10.00
Glanford Brigg R.D.C.	13.00
Grantham Cpn.	13.00
Grimsby Cpn.	13.00
Heanor U.D.C.	10.00
Hinckley U.D.C.	13.00
Hucknall U.D.C.	13.00
Ilkeston Cpn.	13.00
Ipswich Cpn.	35.00
Irthlingborough U.D.C.	10.00
Kettering Cpn.	13.00
King's Lynn Cpn.	13.00
Kirkby-in-Ashfield U.D.C.	10.00
Leicester Cpn.	45.00
Lincoln City	17.00
Lincoln County Council (Parts of Kesteven)	10.50
Lincoln County Council (Parts of Lindsay)	10.50
Long Eaton U.D.C.	13.00
Loughborough Cpn.	13.00
Mansfield Cpn.	17.00
Mansfield Woodhouse U.D.C.	10.00
Newark Cpn.	10.00
Norwich Cpn.	35.00
Nottinghamshire C.C.	45.00
Old Fletton U.D.C.	10.00
Peterborough Cpn.	17.00
Repton R.D.C.	13.00
Rushden R.D.C.	10.00
Scunthorpe Cpn.	17.00
Southwell R.D.C.	17.00
Staveley U.D.C.	10.00
Sutton-in-Ashfield U.D.C.	13.00
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Wellingborough U.D.C.	10.00
Welton R.D.C.	10.00
Wisbech Cpn.	10.00
Worksop Cpn.	13.00
Worksop R.D.C.	10.00

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British Steel Corporation (Tubes Division)	75.00
British Steel Corporation (Chemicals Division)	75.00
Dust Control Equipment Ltd.	23.00
East Midlands Electricity Board	89.00
Franklin, Charles, Ltd.	3.00
Low Temperature Coal Distillers Association	23.00

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McDonald, J. D.	3.00

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Turner, T. Henry	4.00
Wade, A.	3.00
Waring, F. L.	5.25
Weldon, Miss G. M.	3.00
Wright, P. F.	3.00

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Cheltenham Cpn.	23.00
Dursley R.D.C.	10.00
Gloucester Cpn.	23.00
Keynsham U.D.C.	3.00
Lydney R.D.C.	10.00
Mangotsfield U.D.C.	3.00
Norton Radstock U.D.C.	3.00
Poole Cpn.	35.00
Shepton Mallet R.D.C.	3.00
Sherborne U.D.C.	3.00
Sodbury R.D.C.	4.20
Somerset C.C.	65.00
Stroud U.D.C.	10.00
Swindon Cpn.	23.00
Tetbury R.D.C.	3.00
Tewkesbury Cpn.	3.00
Thornbury R.D.C.	13.00
Warmley R.D.C.	10.00
Weston-Super-Mare Cpn.	3.00
West Penwith R.D.C.	10.00
Weymouth & Melcombe Regis Cpn.	13.00

Corporate Members

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South Western Gas Board	52.50
Wilson, J. D., & Partners	23.00

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Coal Merchants Federation of Great Britain	100.00
Eastern Gas Board	100.00
Electricity Council	500.00
Environmental Protection Equipment Manufacturers' Association	100.00
Esso Petroleum Company Ltd.	200.00
Gas Council	1,000.00
Greater London Council	155.00
Imperial Chemical Industries Ltd.	100.00
National Carbonising Co. Ltd.	100.00
National Coal Board	1,000.00
North Thames Gas Board	210.00
Shell International Petroleum Co. Ltd.	300.00
Shell-Mex and B.P. Ltd.	300.00
South Eastern Gas Board	210.00

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Brentwood U.D.C.	17.00
Brighton Cpn.	35.00
Bromley, London Borough of	45.00
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Bushey U.D.C.	10.00
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Dartford Cpn.	13.00
Dartford R.D.C.	17.00
Dover Cpn.	13.00
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Eastbourne Cpn.	17.00
Easthampstead R.D.C.	17.00
Eastleigh Cpn.	13.00
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Elstree R.D.C.	13.00
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Epsom & Ewell Cpn.	17.00
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Gillingham Cpn.	23.00
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Guildford Cpn.	17.00
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Hambledon R.D.C.	13.00
Hammersmith, London Borough of	40.00
Harlow U.D.C.	23.00
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Hastings Cpn.	17.00
Havant & Waterloo U.D.C.	35.00
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Hemel Hempstead Cpn.	17.00
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Luton R.D.C.	13.00
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Rochester Cpn.	17.00
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National Society for Clean Air

ANNUAL REPORT & ACCOUNTS

Year Ending, 31st March 1973

Smoke Control

The period under review has been an interesting and constructive one for clean air and for the Society. When I made my report last year I was able to say that the curve for Smoke Control Orders had taken a satisfactory upward trend. I can now say with considerable pleasure that 1972 proved a vintage year for Smoke Control Orders. Tremendous progress has been made, but not only in smoke control.

Emissions from Road Vehicles

For many years the Society has been pressing the Government to introduce reasonable legislation for the control of emissions from road vehicles. In the latter part of 1972, the Department of the Environment, having consulted interested organisations amongst which was the Society, announced the introduction of regulations regarding emissions of carbon monoxide and hydrocarbons from new cars. The regulations will apply to petrol engined vehicles first used on or after the 1st October 1973 and not manufactured before the 1st April 1973. These should have the effect of reducing emissions of carbon monoxide by up to 30% and hydrocarbons by up to 10% as compared with the emissions from an uncontrolled vehicle. This will be achieved by improved carburation and better timing and ignition controls. The regulation is in conformity with the ECE Regulation No. 15 which requires that a car shall be tested for verification of the average emission of pollutants in a congested urban area after a cold start. The carbon monoxide content of the exhaust gases emitted with the engine idling must not exceed 4·5% by volume. The regulations also require the fitting of a device to prevent gases escaping from the crankcase but you will recall that this has already been law in this country for new vehicles since 1st January 1972.

So far as diesel engined vehicles are concerned, regulations now require all diesel engined vehicles first used on or after the 1st April 1973 and not manufactured before 1st October 1972, to comply with the smoke emission limits laid down in the British Standard on Diesel Engines, BS AU141a/1971. This measure should ensure that smoke emitted is barely visible under all normal operating conditions. Some of us think that this may not go far enough but it is certainly a step forward. Further, the Department of the Environment are currently reviewing ways of strengthening controls over vehicles already in use.

Leaded Petrol

Lead is an emotive subject. There are some who would like to see all lead removed from petrol; others, mostly engineers and oil experts, argue that the retention of some lead is necessary. Notwithstanding this in August 1972, the Secretary of State for the Environment announced a programme for the phased reduction of the lead content in petrol. It was considered that present levels of lead emission should not be exceeded and should if possible be reduced. The programme announced should achieve substantial reductions in emissions of lead from vehicles. The maximum lead content allowable in petrol will be gradually reduced over the next three years.

Membership

The Society itself has had a busy and not unsuccessful year. Membership has not shown a very great increase, but there have been no substantial losses. On the other hand, subscription income has increased and the Society's other activities have been extremely successful. Financially the Society, as the Balance Sheet shows, is in a stronger position.

Annual General Meeting

The Society's Annual General Meeting was held on Friday, 2nd June 1972 at the Connaught Rooms, London. The meeting was well attended and after the purely business items of the Agenda had been dealt with I am glad to be able to say that following the presentation of my report there was a lively and interesting discussion.

Attendance at the Annual Public Meeting which followed the business meeting was again very good. Unfortunately Mr. Peter Walker, the then Secretary of State for the Environment who had agreed to address the meeting, was unable to attend. We were fortunate indeed that Dr. J. W. Barrett, C.B.E., the Immediate Past President of the Institution of Chemical Engineers and the Director (Europe) of Monsanto Chemicals Limited agreed to step in at the last minute and he gave us a very stirring address. His speech was published in full in the autumn 1972 issue of "Clean Air".

The Annual Luncheon, which followed was a most enjoyable affair. Dr. Barrett again spoke although in a very different vein—and many of us who were fortunate enough to attend have been trying to ensure that we remembered all his stories.

Annual Conference, Scarborough

The Annual Conference was held at Scarborough from the 16th to the 20th October. Although we were able to revert to the more normal time of mid-October for our Conference, we were not so fortunate in the weather as we had been in November 1971. Nevertheless, the Conference was very well attended and the weather, although boisterous at times, did not interfere with our activities.

At this Conference we made an experiment in that we opened the proceedings on Monday evening. This meant that the informal get-together was dispensed with and the Opening Session of Conference took place at 8.30 p.m. As you will readily appreciate, by this means we were able to include an extra session in the Conference which we used for an Open Session which took the form of a Clean Air "Top of the Form" Quiz for teams from local schools.

The Mayor of Scarborough, Councillor Miss I. C. Slarke, who, in the time we were all at Scarborough, became a very good friend of the Society, started the proceedings by welcoming everybody at the Opening Session. The Conference was opened by Lord Kearton, O.B.E., F.R.S., the Chairman of Courtaulds Limited one of the Society's industrial members, and the Presidential Address was given by Mr. Stanley E. Cohen, C.B.E., C.C., F.R.S.A. Lord Kearton's address and that of Mr. Cohen were both published in full in the winter 1972 issue of *Clean Air*.

As I have already said, we were able to hold an Open Session at Scarborough on the Tuesday afternoon. This was a "Top of the Form" type quiz for local schools. After advice from the education authorities concerned, 22 schools in the Scarborough, Whitby and Bridlington area were asked earlier in the year if they would allow pupils to take part in this competition. In the event, seven schools stated that they would co-operate and a total of 400 children from the following six schools entered the competition: The Grammar School, Whitby, The Bridlington High School for Girls, The Eskdale County Modern School, Whitby, The Scarborough High School for Boys, The Girls' High School, Scarborough and The Westwood Secondary School, Scarborough. The first part of the competition took the form of a written examination which was held at the end of the summer term in 1972. The judges, provided by the Yorkshire Division who had also set the questions, selected individual prize winners and three schools to be asked to provide teams of four each to take part in the actual quiz which was held on the Tuesday afternoon of Conference. These schools were The Whitby Grammar School, The Scarborough Girls' High School and The Westwood Secondary School, Scarborough.

The Question Master was Alderman Norman Fuller of Scarborough and he was supported by Messrs. Eastwood and Perry of the Yorkshire Division of the Society who acted as "expert" advisers. The three competing teams were seated on the platform at suitable tables which were provided with microphones. The quiz consisted of three rounds of individual questions and two rounds of team questions. The winning team was that from the Westwood Secondary School; Whitby Grammar School was second and The Scarborough Girls' High School, third.

As the schools taking part had brought with them their own supporters, the session was quite lively. The Society is extremely grateful to all the organisations who contributed in any way to the quiz, to the members who so kindly provided generous prizes for the individual competitors and the schools and to the Yorkshire Division for the great part they played in its organisation.

Attendance at all sessions of Conference was good, that at the last session on the Friday morning being particularly so. The papers, as we have now come to expect, were of a very high order and the subjects which they covered broke new ground. As a matter of deliberate policy, the number of papers presented was reduced; this not only allowed the speaker slightly more time in which to develop this theme, but also allowed much more time for discussion. In the event all available time at all discussion periods was fully taken up but this was done without having to cut anybody short and without having to hurry the proceedings.

The Wednesday afternoon was devoted to technical and social visits and the golf and tennis tournaments. There was the usual social programme and I was very happy to be able to entertain some of the Society's friends at a Reception at the Royal Hotel on the Tuesday evening.

Clean Air Spring Seminar

Last year you will recall we held the first Clean Air Spring Seminar in Manchester in March. In the twelve months under review there has been no Spring Seminar but this is not because we have thought fit to discontinue this function but because the 1973 Spring Seminar was actually held at the beginning of April and so does not qualify for inclusion in this report.

United Nations Conference, Stockholm

On the international front, the main interest was centred on the United Nations Conference on the Human Environment held in Stockholm from the 5th to 16th June 1972. This was a conference of high endeavour which served to give meaning to its slogan "Only One Earth", and which explored the problems of the human environment in the broadest sense. Although at the start of the conference there was a clash of outlook between the more wealthy nations and the poorer ones, towards the end there emerged the beginnings of a common understanding of each other's problems. It is to be hoped that this will have a significant bearing on the setting of future environmental objectives and standards. An encouraging feature of the conference was the clear recognition of the need for wide ranging scientific research on the many problems of the human environment, to which end over 100 proposals for action were adopted. As you might expect, a great deal of work was put into the preparation of the evidence which the various nations submitted. In all there were about 12,000 pages in 350 basic documents. Four of these, "Nuisance or Nemesis?", "Sinews for Survival", "How Do You Want to Live?" and "Fifty Million Volunteers" were studies of public opinion in the United Kingdom undertaken by four separate working parties at the request of the Secretary of State for the Environment. These four booklets now form a digest of the vast amount of evidence submitted by organisations and individuals in this country. The Society was one of the organisations who submitted evidence to the Department and some of the Society's views were expressed in "Nuisance or Nemesis?". The working party, under the able chairmanship of Sir Eric Ashby, F.R.S., which produced "Nuisance or Nemesis?" included the Director of the Society among its members.

Arnold Marsh Clean Air Awards

In 1970 the Society hoped to make Clean Air Awards to individuals, to local authorities and to industries who had rendered outstanding service to the clean air movement. In the event, because of organisational and administrative difficulties, it became necessary to defer the making of these awards. I am now very happy to be able to tell you that in recognition of the service rendered to this Society in particular and the clean air in general by the late Arnold Marsh, its first Director, the Council has decided that these awards should be designated the "Arnold Marsh Clean Air Awards" and they have accepted the recommendations of a special committee set up for the purpose.

The awards will in fact be presented to the recipients at the Society's Annual General Meeting. The Select Committee had by no means an easy task but were able to recommend that awards should be made to two individuals, to three local authorities and to two industries. These are as follows: Individual awards—Dr. Gordon Nonhebel, Dr. Albert Parker, Local Authority Awards—the Corporation of London, the City of Salford, the City of Sheffield, Industrial Awards—British Petroleum Company Limited, the Central Electricity Generating Board.

Motor Vehicle Testing

Last year I was able to report that during 1971 the Society, in its campaign against pollution of the air by road vehicles, had carried out a series of tests to measure the carbon monoxide content of vehicle exhausts. During the period under review similar tests were carried out in Birmingham and in Newcastle upon Tyne.

The results of the tests followed a very similar pattern to those obtained at the tests carried out in Brighton, London, Bristol and Southport. Again, drivers were most co-operative and helpful. There is no doubt that these tests proved a very successful publicity project of the Society and at the same time helped to stimulate the interest of the motoring public in the work of the Society to persuade the Government to introduce regulations to control exhaust emissions. Whether or not this work had any significant effect on the decision of the Government to introduce regulations, it is impossible to say, but the fact remains that the Government, as I indicated earlier, have introduced regulations which we consider to be a great step forward.

The Council and its Committees

The Council and its Committees met regularly during the year. At its first meeting, the Council elected me for a further year of office and this I have been very happy to undertake.

The new combined Conference and Publicity Council continued to work well and has had a very full year in preparing the programmes for the Conference at Scarborough and the Spring Seminar in Oxford. It has also been concerned with deciding on conference venues for the future and with the preliminary arrangements for the forthcoming conference at Torquay and the 1974 Spring Seminar which will be held at Sheffield.

The Technical Committee has been very fully occupied with the question of emissions from the exhaust of motor vehicles and with dealing with a number of complaints about emissions, mostly from industrial premises.

The Parliamentary and Local Government Committee has been dealing with such matters as the Straw and Stubble Burning Code, the disclosure of information about emissions from industrial premises, legislation regarding the burning on demolition sites and more recently, penalties under the Clean Air Acts.

The General Purposes and Finance Committee has been engaged on the extremely important but perhaps less glamorous work of finance and the day to day management of the Society. A year ago I was able to tell you that the Committee had also been engaged in the implementation of proposals put forward by the Steering Committee for the restructuring and streamlining of the Council and its Committees. To further this work, the General Purposes and Finance Committee appointed a Reconstruction Sub-Committee to consider those recommendations of the Steering Committee which had not been implemented because of the provisions of the Local Government Act 1972. This Sub-Committee together with the General Purposes and Finance Committee have been extremely busy in preparing a report and recommendations regarding the future of the Society. Some of the recommendations may seem far reaching to some people, but it must be remembered that we live in a time of change and the provisions of the new Local Government Act are themselves far reaching. It is important that the Society should keep pace with the changes that are going on around us. We cannot stand still. As many of you know, the proposals put forward have been circulated to the Divisions for their comments. As might be expected some Divisions are more in agreement with the proposals than others. As a result of Divisional comment the matter is again being considered by the General Purposes and Finance Committee and will have to be fully debated by the Council before the final proposals are put before all members of the Society at an Extraordinary General Meeting which will be called later this year.

Financial Trends

Last year I was able to say that as a result of efforts made during the previous twelve months, the downward trend in the Society's finances over the past few years had been checked. I am very happy now to be able to report that this upward trend in our finances has continued and that from the financial angle, the Society has had a very good year. This however, should not in any way be thought grounds for complacency. Prices continue to rise and it will be necessary to keep subscriptions constantly under review in order to keep up with expenditure and activities. As I said last year, the response from members in the past has been very good indeed, and I have every faith that this will be so in the future.

The Divisions

The Divisions have continued to be active throughout the year.

I have already mentioned the very considerable part that the Yorkshire Division played in making the "Top of the Form" quiz possible at the Scarborough Conference in October. Other Divisions have arranged public meetings and a notable example of this was the very successful meeting held by the South East Division in January. This meeting was held at the Guildhall in the City of London and was addressed by Professor Thring. Such meetings have always proved successful and it is hoped that Divisions, in the future, will be able to arrange many more. These will not only provide a means by which members of the Society can keep in touch with other members and with what is going on, but also provide a means whereby the members of the public can make contact with the Society. The Divisions are the limbs of the Society; if the limbs are not active the body can get nowhere.

Reports of the activities in the Divisions have been published throughout the year in "Clean Air".

Publicity and Public Relations

Requests for assistance from the library and information department have continued at a very high level from schools and colleges, from universities, from industry, from the press, radio and television. The marked increase in requests for information from students and schoolchildren to which I referred last year shows no sign of abating. If anything, the demand has increased. This is an extremely good sign and the Publicity Committee are preparing pamphlets for schools and students accordingly.

Some of you at Scarborough saw the new filmstrip "The Air You Breathe" produced by Mrs. Diana Wyllie in conjunction with the Society. This is an example of one facet of the Society's activities in the field of publicity. Other examples are that members of the Society and of the staff have taken part in radio and television programmes. A large number of speaking engagements have been fulfilled throughout the country. Members of the Society and staff have presented papers at a number of conferences concerned with the environment and the Society has had small exhibition stands at several of them.

The sale of the Society's publications has continued to show an increase. This is a very healthy sign and is undoubtedly helped by the Society's presence at conferences and exhibitions.

One of the notable events of the year was the first Sir Hugh Beaver Memorial Lecture. A series of three memorial lectures is being held to honour the memory of the late Sir Hugh Beaver, K.B.E. The lectures are being sponsored by the Brewer's Society, the National Society for Clean Air and the Institution of Chemical Engineers, three of the organisations with which he was very much concerned during his very active public life. The first of these lectures was delivered on the 6th December 1972 by Sir Norman Kipping, G.C.M.G., K.B.E., who was Director-General of the Federation of British Industry when Sir Hugh was its President. The text of Sir Norman's lecture was printed in the spring 1973 issue of "Clean Air".

The Society and Industry

An important step taken during the period under review, was the founding of EPEMA, the Environmental Protection Equipment Manufacturers' Association. This, an association of manufacturers of equipment for the control of pollution and the measurement of emissions was formed at the instigation of our President. The Society are helping it in its formative period by providing secretarial and administrative support. EPEMA is a member of the Society and has been invited to send a representative to sit on the Council.

Other Activities

The Society has continued to be involved with clean air at government and other similar levels. We continue to be well represented on the Clean Air Council by the President, Mr. Stanley E. Cohen, Commander C. Buist, Mr. T. H. Iddison, Professor R. S. Scorer and the Director. Mr. A. C. Saword and myself are members of the Department of the Environment's Working Party on the Suppression of Odours from Offensive and Similar Trades. Messrs. W. Bate and F. Reynolds are members of the Department of the Environment's Working Party on Grit and Dust Emissions from Combustion Processes. Mr. Philip Draper continues as a member of the appropriate committee of the British Standards Institution concerned with exhausts from diesel engined vehicles. The Director is also a member of committees at the British Standards Institution.

The Society continues to have a strong representation at the Standing Conference of Co-operating Bodies (investigating air pollution). The Chairman, Councillor H. N. Scrimshaw, B.A., is also Chairman of the West Midlands Division. The work of the conference is supported by Warren Spring Laboratory, Director Dr. A. J. Robinson, on behalf of the Department of Trade and Industry.

Staff

There have been no staff changes during the period under review.

Conclusion

I think you will agree that the Society has had an active year. As a consequence the workload has increased for members of the Council and the staff. The Society, for example, has now installed its own small printing machine and is able to undertake the printing of conference and other papers. This has resulted in more work for headquarters staff and this they have willingly undertaken; but it has also resulted in considerable reduction in printing costs. This at a time when such costs are constantly rising has been of great financial help to the Society.

I said last year that the future of the Society depended on the services they could provide for industry and for individuals. I suggested that this might be by the bringing together of manufacturers and buyers of plant, equipment or instruments for measuring pollution. This we have been able to do in helping to set up EPEMA. We are now looking to the restructured Society to deal effectively with the problems of tomorrow. In this way, we hope to provide yet more help for all our members. There is no doubt that the Society's interests are widely spread over the total environment. We have the foundations for a strong technical organisation so let us advance and expand our activities wherever we can apply our collective knowledge and experience for the betterment of human health and well-being.

Acknowledgements

I am sure that all members of the Society will wish to join me in expressing thanks to our Director, Rear Admiral P. G. Sharp, and his staff for their initiative and loyal support throughout the year. The events and activities which I have recorded in this report could not have been achieved without their zeal, enthusiasm and devotion to the objectives of the Society.

S. CAYTON
Chairman

3rd CLEAN AIR SPRING SEMINAR

SHEFFIELD

26th—28th MARCH, 1974

Further details from:
National Society for Clean Air,
136 North Street,
Brighton BN1 1RG.
Telephone: Brighton 26313

THE NATIONAL SOCIETY FOR CLEAN AIR
(Company Limited by Guarantee—Incorporated 1st January, 1958)
BALANCE SHEET AS AT 31st MARCH, 1973

	31.3.72		31.3.73	
	£	£	£	£
FIXED ASSETS (See Notes to Accounts Nos. 1 & 2)				
OFFICE MACHINES AND FURNITURE				
As valued by the Director as at 1.4.72			1,910	
Additions at Cost			2,036	
			3,946	
Less Depreciation (over 5 years)		—	789	
				3,157
LIBRARY BOOKS				
At Nominal Value		—		100
		—		3,257
INVESTMENTS AT COST (See Note 3)				
Fixed Interest Stocks	*3,270*		3,270	
Ordinary Shares	*9,253*		9,253	
		12,523		12,523
CURRENT ASSETS				
Stock of Publications at Director's Valuation	*600*		1,175	
Sundry Debtors	*2,474*		3,520	
Prepayments	*346*		1,672	
Bank Balances	*624*		4,964	
Cash in Hand	*38*		38	
	4,082		11,369	
LESS CURRENT LIABILITIES				
Sundry Creditors and Accrued Expenses	*4,247*		4,967	
Net Current Assets		*(165)*		6,402
Net Assets		*£12,358*		£22,182
Represented by:—				
GENERAL FUND				
Balance at start of year		*8,510*		12,280
Valuations as at 1.4.72—				
Office Machines and Furniture		—		1,910
Library Books		—		100
Surplus for the year		*3,770*		5,814
		12,280		20,104
PREMISES FUND—brought forward		*78*	78	
Add Transfer during year		—	2,000	
				2,078
Balance at end of year		*£12,358*		£22,182

Notes 1 to 7 form part of these Accounts.

W. C. TURNER, M.D. *Honorary Treasurer*
P. G. SHARP *Director and Secretary*

NOTES TO THE ACCOUNTS

1. *Lease*
The Society bought the lease of its Brighton offices which is for 14 years from 15th November, 1965 and the cost of £2,000 was deducted from the Premises Reserve Fund.
2. *Office Furniture and Equipment*
Records are not available to show the original cost of all furniture and equipment which was valued by the Director as at 1.4.72 at £1,910 and has been included in the accounts at this figure. The valuation and future purchases are being written off over 5 years.
3. *Investments*
The market value of the Society's Investments as at 31st March, 1973 was £20,595 compared with £21,658 as at 31st March, 1972, a decrease of £1,063.
4. *Claims against the Society*
The two claims against the Society have been disposed of during the year. One claim was settled for £678 and is included in the charge for information services etc. £1,477. The second claim has not been pursued.
5. *Profit on Conference and Seminars*
The expenses deducted from the Income do not include Salaries and General Expenses.

6. *Commitments*

The Society was at 31st March 1973 committed to the publication of two issues of "Clean Air" at an approximate cost of £2,000.

7. *Divisions*

The ten Divisions of the Society hold balances for local administration purposes which are not brought into these Accounts.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1973

	Year 1971/72		Year 1972/73	
INCOME	£	£	£	£
SUBSCRIPTIONS AND DONATIONS		*20,853*		22,596
CONFERENCE				
Income	*8,000*		10,297	
Less Expenses	*2,979*		3,117	
		5,021		7,180
EXHIBITIONS				
Loss		*(1,131)*		—
MANCHESTER SPRING SEMINAR		*842*		134
MILAN 1971 CONFERENCE AND JOINT VENTURE		*958*		(123)
SALES OF PUBLICATIONS		*2,427*		2,992
INVESTMENT INCOME				
Taxed Dividends (Net)	*814*		872	
Income Tax Repayments	*159*		133	
Bank Deposit Interest	*59*		183	
		1,032		1,188
		30,002		33,967
EXPENSES				
RUNNING COSTS				
Salaries and Wages	*12,107*		12,644	
Staff Pension Scheme	*443*		825	
Rent, Rates, Light and Heat	*1,554*		1,594	
Insurance, Travel, Cleaning and General Expenses	*3,610*		3,631	
Office Equipment and Furniture	*449*		—	
Office Equipment Depreciation	—		789	
Stationery Supplies	*773*		840	
Bank Interest Paid	*58*		—	
Provision for Doubtful Debts	—		150	
	18,994		20,473	
CLEAN AIR AND YEAR BOOK				
Printing, Postage, etc.	*6,585*		7,797	
Less Advertising Receipts	*2,457*		4,060	
	4,128		3,737	
INFORMATION, PUBLICITY SERVICES AND COST OF PUBLICATIONS	*2,881*		1,477	
DIVISIONAL GRANTS (See Note 7)	*228*		466	
	3,109		1,943	
		26,231		26,153
EXCESS OF INCOME OVER EXPENDITURE		*3,771*		7,814
LESS TRANSFER TO PREMISES RESERVE		—		2,000
BALANCE TRANSFERRED TO GENERAL FUND		*£3,771*		£5,814

REPORT OF THE HONORARY AUDITORS OF THE NATIONAL SOCIETY FOR CLEAN AIR

We have examined the Balance Sheet and annexed Income and Expenditure Account. In our opinion the Accounts comply with the Companies Act, 1948 and 1967 and give a true and fair view of the state of the Society's affairs at 31st March, 1973 and of its surplus for the year ended on that date.

33, Furnival Street,
London, EC4A 1JQ.
27th April, 1973

GEO. LITTLE, SEBIRE & CO.
Chartered Accountants

Divisional Reports

East Midlands Division

The Annual General Meeting of the East Midlands Division took place at Brigg in Lincolnshire and was followed by a visit to the Lindsey Oil Refinery. In September 1972 the Council met in the Clowne Rural District and in the afternoon visited the Whitwell Works of the Steetley Dolo-grit Company. This visit and the previous one were both curtailed by rain which was disappointing both for the members and for the organisers.

In March 1973 the Division visited Southwell. In the morning Dr. R. V. Riley of the British Steel Corporation gave a talk on Environmental Considerations in Steel Making. In the afternoon members visited the Kirton Brickworks of the Butterly and Blaby Brick Company. The Divisional Council has met on four occasions during the year. Business discussed included the reconstruction of the Society, Local Government re-organisation, membership and the booklet on Air, Soil and Water pollution.

E. F. RAVEN
Hon. Secretary

Northern Ireland Division

There have been four meetings of the Divisional Council since the last annual review.

The Annual General Meeting was held in B.M.A. House, Belfast, on Wednesday, 24th January, 1973. The Chairman presented his review of the year in which he reported on the highly successful Spring Meeting held in Newcastle, Co. Down in May, 1972.

The following office bearers were then elected:

Chairman, R. Campbell Brown;
Deputy Chairman, W. Jenkins;
Honorary Secretary/Treasurer, J. R. Lamont;
Divisional Council, Alderman Shannon, W. J. Davison, J. S. Gardner, Col. H. J. Porter, A. Reynolds, Dr. J. McA. Taggart, K. H. Lynas, C. Walkington, W. E. C. O'Brien.

Presentations were made to Bill O'Brien on his retirement as Divisional Public Health Inspector in Co. Down and to Brian Hanna who relinquished the post of Honorary Secretary on leaving local government for a new post.

Following the formal business there was a showing of a thought-provoking Thames T.V. film "And on the Eighth Day".

The postponement of Local Government Reorganization until October, 1973 has greatly disturbed the Division's plan for a one-day conference during the year.

Accordingly it is now proposed to hold a Spring Meeting in 1974 and to return to Newcastle, Co. Down.

Despite the continuing unrest in the province Smoke Control has progressed steadily.

The position at the time of this report (August) is:

50 Smoke Control Orders in operation.
5 Smoke Control Orders confirmed but not yet in operation.
2 Smoke Control Orders submitted but not yet confirmed.

JAMES R. LAMONT
Hon. Secretary

North East Division

The Annual Meeting during 1972 was held in the Publicity Centre of Imperial Chemical Industries Limited at Billingham, Co. Durham. A brief description of the arrangements for the day was followed by a coach tour of the works. After the tour delegates assembled to be given an account by the Deputy Chairman of the Agricultural Division of I.C.I. Ltd. of action taken by his organisation in reducing air pollution within their field of operations. At that time the Company was reaching the end of a three-year plan of air pollution abatement and some dramatic facts were given relating to the very considerable reduction in the volume of pollution from dust, SO_2 and ammonia. The Deputy Chairman's address was followed by a short film showing in graphic form the matters to which reference had been made in the Deputy Chairman's address. At the conclusion of lunch a brief speech was delivered by Rear Admiral P. G. Sharp on behalf of the Society in which he expressed gratification at the achievements of I.C.I. Ltd. in the field of pollution abatement.

The Autumn Meeting was held in November in the Park Hotel, Tynemouth when members were guests of the Corporation of Tynemouth C.B. On this occasion Rear Admiral P. G. Sharp attended both as Director of the Society and a member of the Clean Air Council and delivered an address entitled "An Investigation into Smoke Control Progress in the Northern Region". This address was of particular interest to representatives present from the nineteen "black area" authorities of the North East and, although many of the delegates subsequently participating in the discussion did not necessarily agree with the points of view expressed by the speaker, there was little doubt that the Director's lucid address made clear the justification and need for the official investigation carried out in the North East.

During the year, at the request of the Technical Committee of the Executive Council, an investigation was made into the serious smoke nuisance alleged to exist arising from a refuse tip within the area of the North East Division. After the submission of reports ultimately to the local authority concerned, it is pleasing to note that considerable improvement resulted therefrom.

At both meetings during the year the reconstruction of the Society was given much attention, although no firm policy could be adopted until the present proposals were ratified by the Executive Council. Concern was felt, however, that the reorganisation of local government, coupled with the reconstruction of the Society, would create many administrative difficulties, particularly in regard to local authority representation. The 75 local authorities within the North East Division will, after April 1974, be reduced to 29, although the actual area covered will be considerably greater.

During the year enquiries were conducted on behalf of the Parliamentary and Local Government Committee into penalties for clean air contraventions and nuisance arising from the disposal of non-ferrous scrap, although such investigations revealed very few problems in the Division.

Undoubtedly the most stimulating event during the year has been the investigation and report of the Smoke Control Investigation Panel established by the Clean Air Council for the purpose of ascertaining information on the difficulties and obstacles which have prevented the North East making greater progress with smoke control programmes.

Much criticism and, in some cases, resentment had been shown after the publication of the report which named specific authorities as "laggard" authorities. Nevertheless, the mere fact that an investigation had been instituted and pursued and particularly because of the brutally frank nature of the report, it seems that it has had a most salutary effect upon local authority operations in relation to smoke control. Before the end of the year there was an apparent acceleration in smoke control activity and before local government reorganisation in 1974 it is not improbable that the much maligned North Eastern local authorities will have raised themselves from their present low position in the national clean air league table.

L. MAIR
Hon Secretary

Yorkshire Division

There have been four meetings of the Yorkshire Divisional Council and three Open meetings including the Annual General Meeting. Additionally the sub-committee concerned with the programme of meetings met on one occasion during the year. The work of the Divisional Council has been restricted to a large extent by the pressure upon officers and members produced by the reorganisation of Local Government, and inevitably the number of meetings have been reduced. It seems likely that this pattern will continue until after reorganisation has taken effect. During the interim period discussions must take place on the role of the Society in the future and the possibility of expansion to deal with other forms of pollution including noise.

The Divisional Council was involved in the organisation of the Children's Competition for the Annual Conference of the Society at Scarborough, and an ad hoc group of officers prepared lists of questions to be circulated for the Schools Competition and also the questions to be put to school children taking part in the Final "Top of the Form" quiz.

J. H. WYATT
Hon. Secretary

South East Division

The Annual Meeting of the Division was held at the Guildhall, London on January 25th, 1973, when Mr. W. Combey was again elected as Chairman. After the usual business meeting an open discussion was held on several topics, these included the widening interests of the Society, small gas incinerators, grants for conversions of fireplaces in premises not in Smoke Control Areas, and noise legislation.

In the afternoon an Open Meeting was held to which persons had been invited from Local Authorities, Industry, organisations interested in pollution and Universities. Approximately 150 persons were addressed by Professor M. W. Thring, Queen Mary College, University of London on the subject "A Forward Look on Pollution Control". A summary of the address has been published in the Autumn edition of "Clean Air".

The Divisional Council considered a number of matters during the year and these included the proposed reorganisation of the Society, a Diploma for Air Pollution Control, Lead in the Environment, Liaison with other Societies and "Laggard Authorities".

As a result of a survey in the South East it appeared that the reasons for not carrying out smoke control were (1) The rapid growth of towns by development of houses using smokeless fuels, (2) the general conversion of appliances without grant aid and (3) that the authorities were rural in character and smoke control was unnecessary. An interesting point was noted in that some of the measurements for smoke and Sulphur Dioxide in large towns in the South East showed it to be less than some London Boroughs where smoke control had been carried out. The division now seeks means of encouraging some of the larger districts to carry out smoke control but the reorganisation of Local Government might also create a changed position of interest.

R. F. SHAPTER
Hon. Secretary

South West Division

1973 has been a rather difficult but nevertheless eventful year, the heavy calls made on the time of officers and members by local government reorganisation having made the task of maintaining the Division's programme more arduous.

The programme of three meetings per year has been continued, however, the first meeting being the Annual General Meeting in March which this year was held in Bath. Last year's precedent of holding the annual general meetings of both the Divisional Council and the Division in the morning was followed, thus allowing the afternoon to be used for an open meeting. Admiral Sharp was the guest of the Division on this occasion and he together with the officers and representatives of the Divisional Council were entertained to luncheon in the Pump Room by His Worship the Mayor of Bath, Alderman Ricketts. The attendance at the open meeting was in excess of 60, including a number of sixth form students from Bath schools. The Division was privileged to have Admiral Sharp as the speaker and the afternoon was devoted to the subject of Domestic Smoke Control—the need for greater progress in the South West. This may appear to be 'old hat' to many people in other Divisions but Bristol apart, the other large authorities in the South West are officially classified as 'white areas' and many have ignored smoke control to their cost. In a stimulating talk Admiral Sharp drew attention to the decreasing relevance of 'black' and 'white' areas, referring to the fact that so-called black towns were now cleaner than the white towns and cited Bath, Blackpool and Brighton as examples—the 1969/70 Winter average smoke concentrations for Bath being the same as a similar site in Burnley!! Much interest both in the work of the Society and domestic smoke control was stimulated by the metting and it can be regarded as a good public relations exercise.

The June meeting was held at the works of R. A. Lister and Company of Dursley, Gloucestershire. The purpose of the meeting was to see the measures taken by the firm in the fields of air and water pollution control and noise control. The Company who were originally agricultural engineers are world famous manufacturers of diesel engines and the tour of the works included the foundry, the engineering shops and the engine testing shop. After the tour of the works, members were entertained to tea by the management who dealt with the many questions and points of discussion.

The arrangements for the November meeting had not been finalised at the time of going to print but it is anticipated that this will be held in the south of the Division's area at the Atomic Energy Establishment at Winfrith in Dorset.

During the year special sub-committees have been established to consider the recommendations of the Reconstruction Sub-Committee and to decide upon the Division's involvement in this years Annual Conference at Torquay.

Two new members, Exeter County Borough Council and Somerset County Council, have joined the National Society after approaches from the Division.

For the second year in succession the retirement of one of the key members of the Division has to be recorded. The Assistant Secretary and the Division's representative on the Executive Council, Graham Dhenin retired in August. Graham has been involved in the activities of the National Society for over 30 years, was one of the stalwarts both of the Society and of the old Bristol and West Clean Air Committee and having been the sole representative of the South West on the Executive Council for many years has worked on all the major committees of the Society. He has been as ever present to Annual Conferences and his experience and enthusiasm will be impossible to replace. If I might be permitted a personal comment, I wish to record my appreciation for his great support as Assistant Secretary and his advice and guidance which has never failed me. The Division and indeed the National Society for Clean Air wish Graham a long and happy retirement.

D. J. BARNETT
Hon Secretary

North West Division

The Annual General Meeting of the North West Division of the Society was held at the Pembroke Hall, Worsley on 17th May, 1972. On this occasion the members of the division were able to hear Dr Kay of the National Coal Board who described the various types of new heating appliances capable of burning coal smokelessly, Mr Roger Payne of Coalite and Chemical Products told members the position regarding the supply of solid smokeless fuels and said the supply of solid fuel for the future was assured.

The members of the division were entertained to luncheon by the National Coal Board and Coalite and Chemical Products Ltd.

The Divisional Council met on four occasions during the year and at the first meeting Mr R. G. W. Hollingdale of the North West Gas Board was elected Chairman of the Divisional Council and Mr. L. Goodman of the National Coal Board was elected Vice-Chairman.

Mr. H. Clusky was elected Honorary Treasurer and Mr. W. E. Pollitt was elected Honorary Secretary for the ensuing year.

The Divisional Council has concerned itself with the reorganisation of the National Society which is a matter not yet finalised and the refusal of the Minister of the Environment to approve initial orders from a local authority who has not submitted a phased programme. This matter has been brought to the notice of the National Executive Council of the National Society and to the amazement and consternation of the North West members of the National Executive we did not receive the support of the rest of the members of the National Executive. A further effort to obtain the support of the National Executive was successful and the matter is to be taken by the Society to the Minister of the Environment.

Much work has been done in the educational field by the provision of speakers to Church Groups, Housewives Guilds, Colleges, Universities and the provision of literature dealing with all aspects of pollution.

The Divisional Council regret that during the year under review, it has not been possible to arrange more than one meeting which was open to all the members of the division, this we feel is due to the economic situation and the difficulty industrial concerns have experienced over the past year. The one open meeting was a visit to Messrs. Belling Limited of Burnley, when members toured the factory and saw the construction of a whole range of electric appliances and were entertained to luncheon by the Board of Directors.

The year ahead will bring the much awaited Local Government Reorganisation which we hope will also bring us nearer to an ideal environment with a smoke-free atmosphere.

W. E. POLLITT
Hon. Secretary

Scottish Division

The Division met on two occasions during the year and the Executive Committee had one meeting, the Annual General Meeting being held in Inverness prior to the Conference. At the Annual General Meeting, Dr. W. A. Horne demitted office as President and was succeeded by Councillor Rina T. Nealon of Edinburgh. The Division wish to record their appreciation of the services rendered by Dr. Horne during his term of office.

The Conference was held in Inverness from 17th to 19th May and the following papers were given, viz: "Sulphur Removal—from Fuel and Flue Gases" by Dr. W. Gibb of Strathclyde University; "Potential Hazards of Industrial Development in the Highland Region" by Dr. M. Murchison, Medical Officer of Health, Inverness County Council; Atomic Power" by Dr. J. Lockie of the South of Scotland Electricity Board; "North Sea Oil" by Mr. T. Junor of Shell and B.P. Ltd.; and "Contemporary Sources of Air Pollution" by Dr. J. S. S. Reay of Warren Spring Laboratory. The Conference was opened by Mr E. M. Matthew, Deputy Regional Officer of the Nature Conservancy. All of these papers were most informative and proved of great interest to the delegates. On 18th May, Inverness Town Council provided a civic luncheon for the delegates and the Scottish Gas Board provided a cocktail party.

During the course of the year the Division concluded discussions with the University of Strathclyde for the sponsoring of a post-graduate research project into air pollution in West Central Scotland. It is anticipated that the project will run for a period of two years and that the cost will be in the region of £2,000. The fuel interests and the majority of the local authorities in the area have contributed towards the cost.

The basic aim of the research is to assemble and evaluate the existing material on air pollution within the area in order to produce a reliable and co-ordinated picture of the present situation. It is expected that this initial survey will not only reveal the deficiencies in recording networks and data sources but will also highlight the main themes and areas within the Central valley which are capable of supporting more detailed investigation.

It is proposed to adopt a geographical approach throughout, and a series of maps will be produced illustrating the pollution sources in relation to local environmental factors with some attempt to classify the severity of the pollution hazard over the area. Particular attention will be paid to the accumulation or dispersal of pollution in relation to local conditions, and emphasis will be given to the economic and social consequences of pollution. It is expected that the work will be of practical significance and that local authorities and planning organisations will be able to utilise the information in relation to future industrial and residential development strategies.

The Division feel that this research is important and very necessary from both a social and economic point of view since information will be provided which, at this stage, is not available and which will prove of considerable benefit.

The 57th Annual Winter Session of the classes for firemen, boiler attendants, engineers, etc. organised by the Division, in conjunction with the Corporation of Glasgow's Health Department, commenced in October and attendances continue to be encouraging.

F. J. FEELEY
Hon. Secretary

South Wales & Monmouth Division

A meeting of the South Wales Division was held on the 20th November at Afan Lido. The meeting was addressed by Admiral Sharp who spoke on the re-organisation within the Society and the extension of its activities. The Chairman, Councillor Mrs P. M. Mainwaring also introduced the Mayor, Alderman Warren, who gave a civic welcome.

Following a lively discussion lunch was partaken at the Lido. After lunch those attending were divided into two parties: The first party visited the British Steel Corporation Plant and Tidal Harbour, a £19m complex. They then went on to the Basic Oxygen Steel Making Plant and were then entertained to tea by the British Steel Corporation.

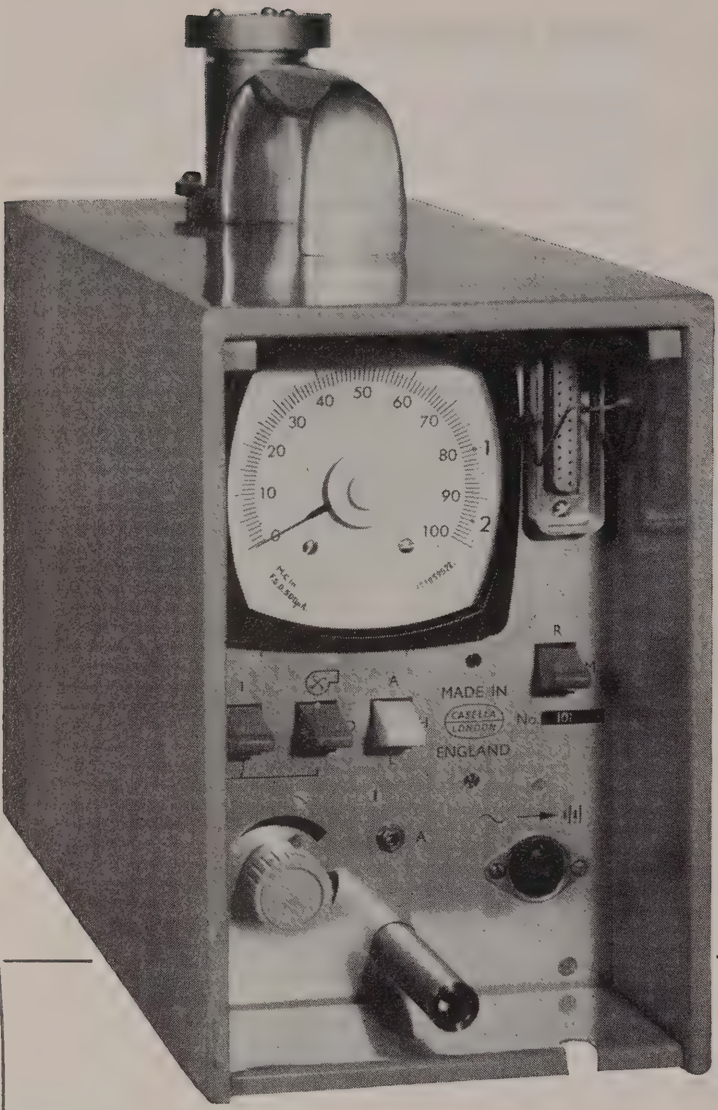
The second party visited BP International where, after talks by Dr Roland Jenkins the Environmental Officer for BP International and Mr Rod Rees the Public Relations Officer, a tour was made of the new £120m complex. Special attention was paid to the new multi-purpose incinerator.

L. MORGAN
Hon. Secretary

West Midlands Division

Because of the reorganization of local government in the West Midlands, there has been little Society activity as such. However, an interesting visit was made to a copper smelting works in West Bromwich at the end of 1972, and following the departure of Mr F. Reynolds, the Honorary Secretary of the Division to a new appointment at Leeds, the Divisional Council have been engaged in the reorganization of the Division to take account of the many changes caused by the Local Government Act and the restructuring of the Society.

S. CAYTON
Acting Hon. Secretary



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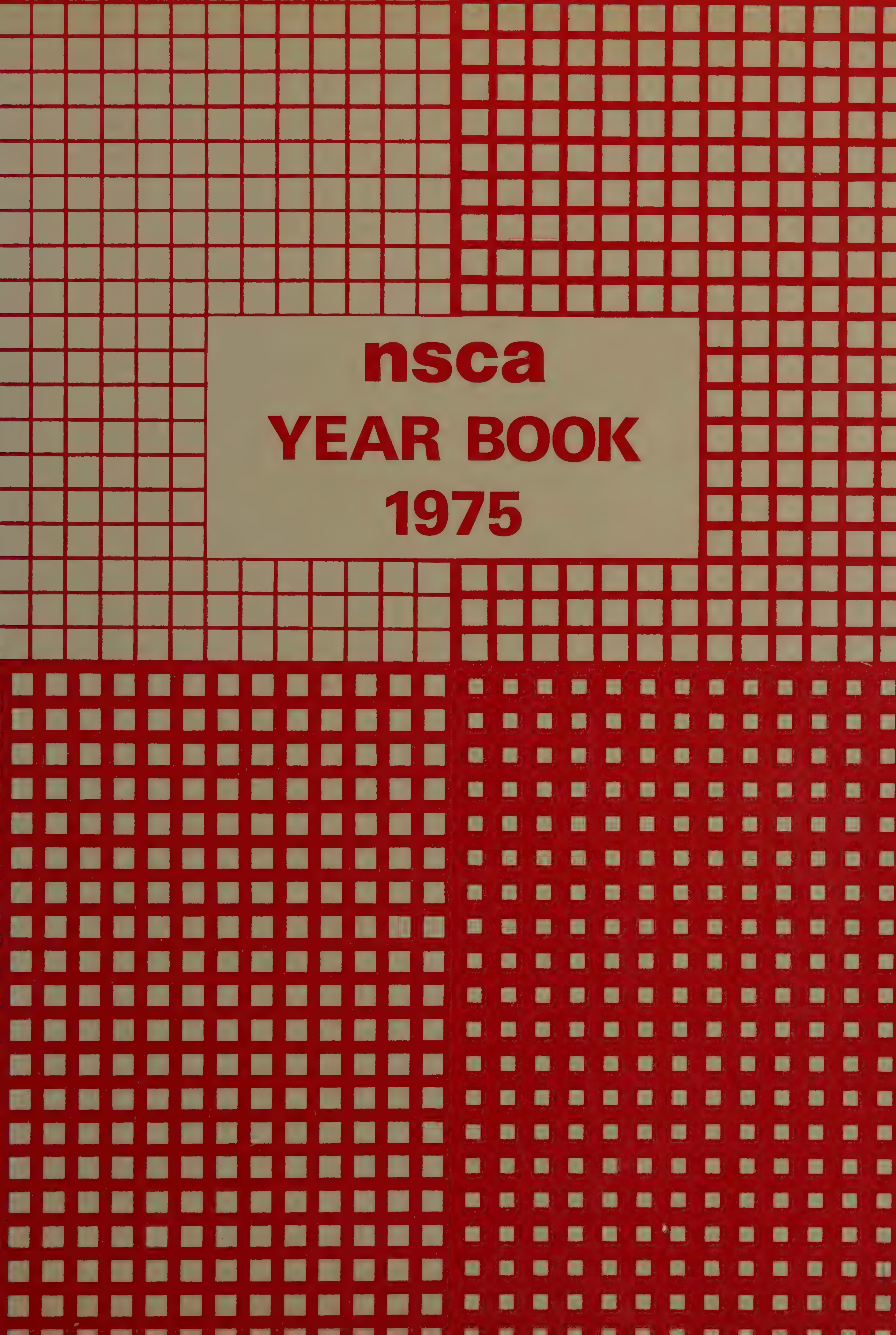

nsca
YEAR BOOK
1975

Clean power for the people

The Central Electricity Generating Board has received the following awards for environmental schemes:

RIBA Award	1952	Staythorpe power station
Civic Trust Award	1959	Tafalog Weir, Dolgarrog
	1962	Felin Newydd Weir, Rheidol
	1968	West Burton power station
	1969	Midlands Region HQ, Solihull
Welsh Tourist and Holidays Association Award	1964	Stwlan Dam & Rheidol Valley
Countryside Award	1970	Didcot nature trail
	1970	Drakelow field study centre
	1970	Hartlepool field study centre
	1970	Peterborough land reclamation
	1970	West Burton landscaping
RICS/Times Conservation Award	1973	Wymondley substation site
Arnold Marsh Clean Air Award	1973	CEGB cleaner air development

NATIONAL SOCIETY FOR CLEAN AIR
YEAR BOOK

Contents

Clean Air Progress 1973/4 3

Section 1—The Society 5
Information about the Society 6
NSCA Officers, Council and Staff 7
Divisional Reports and Lists of Members 8
NSCA Annual Report and Accounts 16

Section 2—Air Pollution 23
An Outline of the Law Relating to Air Pollution 24
The Ringelmann Chart 45
British Standards 47
Glossary of Terms Relating to Air Pollution 50
Estimates of Air Pollution 63
Comparison of Statistics 66
Smoke Control Areas 69
The History of Air Pollution and its Control in Great Britain 74
Major Smog Disasters 75
The Clean Air Case 76
The Cost of Air Pollution 77

Section 3—Noise 79
Noise and the Law 80
Noise and Noise Measurement 81
British Standards 83

Section 4—Water 85
Water Pollution Control in Britain 86
British Standards 88

Section 5—Pollution of the Land 89
Solid Wastes 90
Disposal of Industrial Wastes 91
British Standards 94

Section 6—Conservation 95
Energy—The Crisis and After 96
Recycling for Conservation 97

Section 7—Current Research Programmes 98
Current Government Research 99
Warren Spring Laboratory 108
Central Electricity Generating Board 109
NIFES 110
The Medical Research Council's Air Pollution Unit 111
EPEMA 113
The Atomic Energy Research Establishment 113

Section 8—Guide to Publications 116
Recent Acquisitions to the NSCA Library 117
Films and Filmstrips 119
Guide to Publications 127

Section 9—Directories 134
The International Union of Air Pollution Prevention Associations 135
Directory of Consultants 136
Trade Directory and Buyers' Guide 139
Directory of Organisations 148

Index to Advertisers

The Central Electricity Generating Board Cover ii
Coalite and Chemical Products Ltd 2
C. F. Casella & Co Ltd 20
Geldia (London) Ltd 62
Solid Smokeless Fuels Federation 78
Western Precipitation Division of Joy Manufacturing Co (UK) Ltd Cover iii
National Carbonising Co Ltd Cover iv

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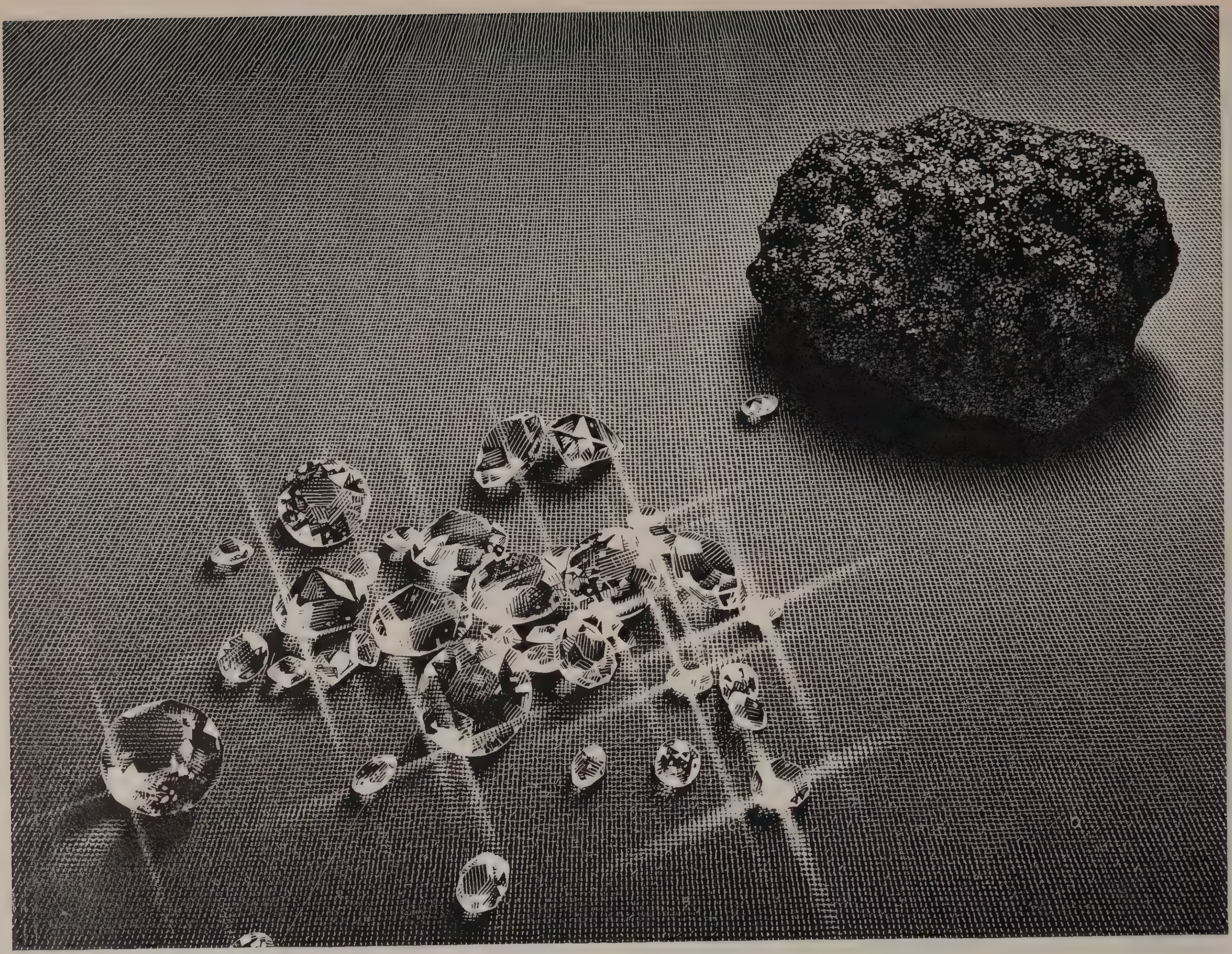

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Clean Air Progress

A Review for 1973/74

In the last issue of the Clean Air Book the review of clean air progress finished by saying that 1973 had been a good year for clean air. It is therefore fitting to be able to say at the start of this review that the twelve months under consideration constituted a good year for the environment.

1974 saw the enactment of two important pieces of legislation and the implementation of others. In July, the Royal Assent was given to the Control of Pollution Act. This is the first statute addressed solely and specifically to the various forms of pollution and thus reflects the increasing concern and interest shown for the subject by all sections of the community, and governmental and scientific agencies at all levels. It is significant that this legislation, originally introduced as the Protection of the Environment Bill by one government, fell as the result of a change of government in February 1974. But the succeeding government immediately re-introduced the bill under a new name, and it has now become law. Its provisions impose new duties and responsibilities on county councils, district councils and water authorities; and it alters the roles which these authorities have previously assumed. Inevitably, these changes in the law and the administrative arrangements for its enforcement will have a significant impact on those in trade, commerce and industry who will be called upon to comply with the requirements of the Act. The architects of the Act believe that if all its objectives are realised, various forms of pollution will be reduced, the environment will be afforded greater protection and the quality of life enhanced.

The Control of Pollution Act seeks to minimise pollution of land by waste products; it extends the existing law on water pollution to virtually all inland and coastal waters; it provides for a more extensive control of noise; and it augments the law relating to air pollution.

The Health and Safety at Work Act also received the Royal Assent in July 1974. At first sight, this Act would not seem to have such an effect on the control of pollution. Obviously, as its name suggests, the main purpose of this measure is to provide for one comprehensive and integrated system of law dealing with health, safety and welfare of work people, and the health and safety of the public as affected by work activities. It is this latter requirement which could have a profound effect on the existing legislation regarding air pollution, for the Act sets up a health and safety Commission and an Executive to be generally responsible for administering "the relevant statutory provisions" and for the Commission and Executive to bring together all the various national inspectorates concerned with health and safety at work and with the general public as affected by work activities; and for the Commission and Executive to exercise the responsibilities which hitherto were exercised by different government departments under existing legislation.

This means that the Alkali and Clean Air Inspectorate are responsible to the new Executive and the Commission, although it is likely that the Inspectorate will retain its identity as such within the Executive. The new Commission was set up on 1st October, 1974 and on 1st January, 1975 the Executive was set up and the various Inspectorates, i.e. the Alkali and Clean Air Inspectorate, the Factory Inspectorate, the Safety in Mines Inspectorate etc were merged. Some sections of the Alkali Act were repealed on 1st January and replaced by Regulations; the remainder of the Alkali Act will be repealed and replaced by further Regulations on the 1st April, 1975.

Details about this new legislation are to be found in the appropriate sections of this publication.

1974 also saw the implementation of the reorganisation of local government and the setting up of the Regional Water Authorities. These two happenings, together with the new legislation, will also have a considerable effect on the environment. It is not insignificant that most district councils, now responsible for clean air, have set up environmental health departments.

Turning more specifically to clean air and the domestic front, in our last review it was suggested it might not be possible to maintain the rate of progress in smoke control seen in 1972 and the beginning of 1973. In the event, in 1973, 310 smoke control orders were confirmed. This represents a decrease of 14% on the total for 1972, but in the circumstances this was a not inconsiderable achievement. As is only to be expected, because of the upheaval caused by local government reorganisation in the spring of 1974, the figures for the first nine months of 1974 are somewhat lower at 164 smoke control orders confirmed. Nevertheless progress is being maintained.

In our last review, we also said that it had become clear that there really was no longer any need to distinguish between the "black" and "white" areas, and that this was already being discussed by the Clean Air Council. Ever since the Beaver Report of 1954, local authorities have been described as "black" or "white" for smoke control purposes. The aim of this designation was to indicate in broad terms, the nearly four hundred local authorities where it was thought there was the greatest need to introduce domestic smoke control. However, the Secretary of State for the Environment and the Secretary of State for Wales decided in September, 1974 that progress under the Clean Air Act 1956, particularly in many of the so called "black" areas had caused the original designation to become out of date. Indeed, in some instances there was a greater need for smoke control in some of the original "white" areas than in those much improved "black" ones where imaginative smoke control programmes had achieved so much. Accordingly, on the advice of the Clean Air Council, the Secretaries of State took the opportunity afforded by local government reorganisation to make changes in the procedures for smoke control orders.

As from 23rd September, 1974 the classification of "black" and "white" areas was abolished. From that date each area will be assessed on its merits. The Secretaries of State recognised that local authorities themselves are in the best position to assess local conditions, and it will be for them to take the initiative and institute the smoke control orders. Local authorities are therefore urged to review the progress made by their predecessors themselves and to determine what further parts of their area should be subject to smoke control and how soon this can be achieved. In this respect it seems clear that the Department of the Environment expect that almost all the former "black" areas will be considered to be areas "that should at some stage have smoke control, and that a substantial number of "white" areas will also be so regarded."

The National Society for Clean Air welcomes these changes and hopes that they will give the necessary impetus to the new local authorities to complete their smoke control programmes.

On the industrial front, as foreshadowed in the last review, Section 4 of the Control of Pollution Act empowers local authorities to collect and consider information about air quality and emissions to the atmosphere, to publish reports and to work as a local source of knowledge.

Altogether, the changes which have occurred and the legislation which has been enacted during the last twelve months, should have a beneficial and lasting effect on the environment.

SECTION 1

THE SOCIETY

Page

Information about the Society 6

NSCA Officers, Council and Staff 7

Divisional Reports and Lists of Members 8

NSCA Annual Report and Accounts 16

THE NATIONAL SOCIETY FOR CLEAN AIR

The parents of the Society were the Coal Smoke Abatement Society, established in London in 1899. In 1905 this Society combined with the Smoke Abatement League, a group of Provincial associations and became the National Smoke Abatement Society. The Society has since widened its horizon to cover all forms of air pollution and in 1958 the name was changed to the present one. The Society's membership includes private individuals both at home and abroad, local authorities, corporate bodies representing the learned societies and institutions, the fuel industries and industries concerned with the production of appliances and equipment for the control of air pollution.

The Society's object is to promote public education in all matters relating to the value and importance of clean air; and to initiate, promote and encourage investigation and research into all forms of pollution in order to achieve its reduction or prevention.

The Society publishes the proceedings of its annual conference in full. Other main publications are the quarterly journal *Clean Air* and the *Clean Air Year Book*. Pamphlets, leaflets and booklets on particular subjects are also published from time to time.

The Society's main activities are the holding of conferences, meetings, exhibitions, arranging lectures and providing educational and publicity material; collecting and disseminating information in the form of books, periodicals, photographs and slides about the causes, effects and prevention of atmospheric pollution and other forms of pollution as they affect or are affected by atmospheric pollution.

General advice, assistance and information on such matters are available free of charge to members. The Society's Library is available for the use of all members, both for consultation in the Society's offices or for loan purposes. Students or research workers may also use the facilities provided. The Library possesses an extensive collection of British and foreign books, reports and papers on air pollution and related subjects. The Society also has a classified collection of photographs (mainly black and white) depicting domestic and industrial smoke, damage to buildings, stonework and plants and other allied subjects. A small collection of slides and filmstrips is also available for loan.

The Society is pleased to help members and others in any part of the country to arrange lectures and talks and is prepared to consider participating in suitable exhibitions. A mobile modular exhibition stand is available for this purpose. The Society's Publicity Advisory Service is available to help Local Authorities and Corporate Members with clean air publicity, especially when Smoke Control Orders are pending. The Society advises members on display material and its arrangement for exhibitions. It supplies information for public meetings, local press features and correspondence. Special pamphlets and information are available to schools, school children and students. No charge is made for this service to members.

SUBSCRIPTIONS

(*The following is an extract from the current Bye-laws of the Society*).

Annual Subscriptions shall be as hereinafter provided. A first annual subscription shall be made on application for Membership and shall continue in force until the first day of April of the following year, when it shall be renewable.

(a) Individual Members

The annual subscription payable by an Individual Member shall be not less than Three Pounds. On attainment of the age of 65 on payment of a sum of Ten Pounds, Individual Members may, at the discretion of the Council retain their membership of the Society in perpetuity, but always subject to the Council's rights of removal.

(b) Student Members

The annual subscription payable by non-graduate students pursuing their studies at school, college or university shall be One Pound.

(c) Local Authority Members

The annual subscription payable by a Local Authority shall be not less than as follows. For Local Authorities with a population of:

Less than 100,000	£ 50.00
100,001 to 250,000	£ 60.00
250,001 to 500,000	£ 75.00
500,001 to 1,000,000	£100.00

For each additional 500,000 or part thereof £10.00

(d) Corporate Members and Unincorporated Bodies appointed in accordance with Article 4(e) (ii)

The annual subscription payable by Corporate Members and Unincorporated Bodies shall be not less than as follows:

(i) Small local civic societies, colleges, schools and similar organisations £5.00.

(ii) Regional and national societies and similar organisations, consultants and small industrial and commercial firms £30.00.

(iii) Industrial organisations £50.00.

(e) Sustaining Members

The annual subscription for Sustaining Members shall be not less than £100.00.

(f) Membership—Special Cases

The Council shall have power to elect any applicant for Membership to an appropriate grade of Membership, on such special terms as to subscription or otherwise as after considering any reasons for so doing stated by such applicant the Council may think proper.

NATIONAL SOCIETY FOR CLEAN AIR

136 North Street, Brighton BN1 1RG

Telephone: Brighton 26313

Honorary Officers

President: H. B. Greenborough.

Immediate Past President: Stanley E. Cohen, C.B.E., C.C., F.R.S.A.

Hon. Treasurer: R. A. W. Hollingdale.

Chairman of Council: Miss M. George, C.B.E., B.A., Companion I.E.E.

Deputy Chairmen: J. Clancey, O.B.E.
P. Draper, C.Eng., F.I.Mech.E., M.Inst.F.

Immediate Past Chairman: W. Combey, D.P.A., F.A.P.H.I., F.R.SH

Hon. Solicitors: Messrs. Wedlake Bell.

Hon. Auditors: Messrs. Geo. Little, Sebire & Co.

The Council of the Society

Elected Divisional Representatives:

Scotland: T. Johnstone, J. R. McGhie, I. W. Wintour.

Northern Ireland: J. R. Lamont.

Northern: L. Mair, Cllr. L. Poole, Cllr. R. J. K. Shepherd.

North West: T. Baxter, H. Clusky, C. Darley, L. Goodman, R. A. W. Hollingdale, W. E. Pollitt, J. Teal.

Yorkshire: L. Eastwood, J. Mernagh, A. W. Perry, W. B. Twyford.

West Midlands: J. Holston, G. R. Lindfield, Mrs. G. M. Nicholls.

East Midlands: R. S. Chamberlain, K. R. Enderby, D. F. Haynes, T. Henry Turner.

London and South East: T. Barley, M. Beaumont, J. Clancey, R. Herbert, Miss O. Kenworthy, A. G. O'Gilvie, Prof. R. S. Scorer, G. C. Stubbs, K. J. Winton.

Central Southern: W. Combey, R. F. Shapter, B. C. Upton.

South West: T. K. Aston, D. J. Barnett, P. Draper.

South and Mid Wales: W. Bate, L. Morgan.

Appointed Representatives of National Bodies:

Asbestos Information Committee: A. A. Cross.
Association of Public Health Inspectors: T. H. Iddison.
British Gas Corporation: T. A. Dick.
British Medical Associaton: Dr. W. C. Turner.
British Steel Corporation: G. E. Speight.
Central Electricity Generating Board: A. J. Clarke.
Electrical Association for Women: Miss M. George.
Electricity Council: C. J. George.
E.P.E.M.A.: K. S. Dunn.
Industrial Gas Cleaning Association: K. H. Pearson.
Institute of Fuel: B. Lees.
Institute of Petroleum: H. I. Fuller.
Institution of Gas Engineers: Dr. F. A. Burden.
Low Temperature Coal Distillers' Association: R. Pane.
National Coal Board: R. W. C. Wheatley.
Royal Society of Health: W. Bate.
Solid Smokeless Fuels Federation: H. Giblin.
Women's Solid Fuel Council: Mrs. J. Saunders.
Women's Gas Federation and Young Homemakers: Mrs. C. Gimpel.

Secretary General: Rear Admiral P. G. Sharp, C.B., D.S.C.

DIVISIONAL REPORTS
and
Membership as at 1st December 1974

Division 1
SCOTTISH DIVISION

President: I. B. Anderson
Hon. Secretary: F. J. Feeley

During the year, the Division and the Executive Committee each met on two occasions.

The Annual Conference was held in St. Andrews from 29th to 31st May. This conference was very well attended and was very successful, both from a business and social point of view. At the Annual General Meeting which was held during the conference, Mrs. Rina T. Nealon of Edinburgh retired as President of the Division and was succeeded by Mr. I. B. Anderson, Director of Environmental Health of Port Glasgow. Mrs. Nealon has been appointed Chairman of the new Lothians Health Board, and the Division wish her well in this new post. Details of the conference were published in a recent edition of "Clean Air".

The Firemen's Classes, organised by the Division in conjunction with the Corporation of Glasgow, were successful as regards the standard achieved by those attending but not so successful so far as numbers were concerned. There seems to be a trend away from evening classes and the Firemen's Classes are suffering. However, efforts are being made to try to encourage local authorities in particular to give greater support. This was the 58th year of the Classes.

The post-graduate research project sponsored by the Division is progressing satisfactorily and the report is expected early in 1975.

The Division are concerned about the effect on membership of the reorganisation of local government in Scotland which takes place in May, 1975. The number of local authorities in Scotland will be greatly reduced and there is a possibility that membership will be similarly reduced. However, an initial approach has already been made to some of the new District Councils, who are charged with the responsibility of controlling pollution, and the response has been encouraging. An approach was also made to all the new Health Boards inviting them to take membership, but only one, the Lothians Health Board, accepted.

F. J. Feeley
Hon. Secretary and Treasurer

Membership List

Sustaining Members
South of Scotland Electricity Board
The Scottish Gas Board

Local Authority Members
Aberdeen Cpn.
Airdrie Cpn.
Ayr Cpn.
Ayr C.C.
Barrhead, Burgh of
Clackmannan C.C.
Clydebank Cpn.
Coatbridge Cpn.
Dumbarton Cpn.
Dumfries Cpn.
Dunbarton C.C.
Dundee Cpn.
Dunfermline Cpn.
East Kilbride Cpn.
Edinburgh Cpn.
Falkirk Cpn.
Fife C.C.
Glasgow Cpn.
Grangemouth Cpn.
Hamilton, Burgh of
Hawick, Burgh of
Inverness Cpn.
Irvine, Royal Burgh of
Johnstone Cpn.
Kilmarnock, Burgh of
Kilsyth, Burgh of
Kircaldy, Royal Burgh of
Kirkintilloch, Burgh of
Lanark C.C.
Motherwell & Wishaw, Burgh of
Paisley Cpn.
Perth C.C.
Perth Cpn.
Port Glasgow Cpn.
Renfrew C.C.
Renfrew, Royal Burgh of
Rothesay, Royal Burgh of
Rutherglen, Royal Burgh of
Stirling C.C.
Stirling, Royal Burgh of
West Lothian C.C.

Corporate Members
British Steel Corporation (General Steels Division)
North of Scotland Hydro Electric Board
Scottish Rexco Ltd.
Waldie and Cameron Ltd.

Individual Members
Broadbent, J.
Christie, J. H.
Foreman, J.
Gibb, Dr. W.
Hally, J.
Horne, Dr. W. A.
McPherson, I.
Moule, Rev. J. W.
Potter, G. N.
Ramsey, Captain E. C.
Slimming, D. W.
Snodgrass, Mrs. C. L.

Division 2
NORTHERN IRELAND DIVISION

Chairman: R. Campbell Brown
Hon. Secretary: J. R. Lamont

There have been two successful and well attended meetings of the Division during the year.

The Annual General Meeting was held in B.M.A. House, Belfast, on 29th January, 1974. The chairman, Mr. R. Campbell Brown, presented his review of the year 1973. At the end of the formal business and following afternoon tea, Dr. Peter Leyshon, Principal Lecturer at the school of Biological and Earth Sciences, Ulster College, Northern Ireland Polytechnic, gave a full and fascinating exposition of the world situation in respect of primary energy resources.

The major event of the year was the spring Meeting in Newcastle, Co. Down, on 2nd April.

This was a highly successful occasion, and was fully reported in the Summer edition of "Clean Air".

During the year, consideration was given to the reconstruction of the Society and efforts were made to encourage the newly constituted Local Authorities to join the Society.

J. R. Lamont
Hon. Secretary

Membership List

Local Authority Members
Antrim District Council
Armagh District Council
Ards Borough Council
Ballymena Borough Council
Belfast City Council
Carrickfurgus District Council
Castlereagh District Council
Coleraine District Council
Cookstown District Council
Craigavon District Council
Larne District Council
Lisburn Borough Council
Londonderry City Council
Newry & Mourne District Council
Newtownabbey District Council

Corporate Members
Coal Advisory Service
Eastern Health & Social Services Board

Individual Members
Cave, S. A.
Dunbar, H.
Ellison, C. A.
Hanna, B. P.
Hinchcliff, D.
Hood, N. R. J.
Jenkins, Major W.
Lamont, J. R.
Lynas, K. H.
Magee, J. L.
Mullar, J.
O'Brien, W. E. C.
Porter, Col. H. J.
Reynolds, A.

Division 3
NORTHERN DIVISION

Chairman: Cllr. L. Poole
Hon. Secretary: L. Mair

There is little doubt that the past year has been one of the most difficult experienced by the North East Division for many years, mainly because of the dislocating effects of local government reorganisation and the impending reorganisation of the Society itself.

Prior to these events the Division held its Annual General Meeting on the 27th April, 1973, at Coal House, Team Valley Trading Estate, Gateshead, as guests of the Solid Fuel Advisory Service. Some 60 delegates visited Lambton Coke Works, after which they were entertained to lunch by the kind invitation of the Solid Fuel Advisory Service. Lunch was followed by the Annual General Meeting which resulted in the re-election of Mr. B. N. Young, O.B.E., as Chairman, Professor P. C. G. Isaac and Councillor T. P. S. Prudham as Vice-Chairmen, Mr. L. Mair as Honorary Secretary and Treasurer and Mr. C. J. Davies as Honorary Auditor. After the business of the meeting was concluded, delegates then visited an exhibition staged at the Heat Centre in Newcastle-upon-Tyne, from which, after tea, members dispersed.

Towards the end of the year it was becoming clear that the concurrent reorganisation of the Society and local government would create considerable difficulty in maintaining satisfactorily a members' register for the Division. Whereas the North East Division comprised 43 local authorities represented by 100 delegates, the new Northern Division now has, in addition, within its geographical boundaries the county of Cumbria but, because of the amalgamation of various districts throughout the counties of Northumberland, Tyne and Wear, Durham, Cleveland and Cumbria, the number of authorities in the Northern Division is now only 29, for which the maximum number of members to be appointed to represent these authorities is 116. It will, therefore, be seen that 116 is the optimum number of local authority representatives which can be appointed in the Northern Division and even then only if every local authority plays its full part in the work of the Division.

It was clear, however, at the end of 1973 that all local authorities were much too pre-occupied with their own reorganisation problems to consider the effects of this reorganisation on the administration of our Society. Indeed, by the 1st April, 1974, only 16 representatives had been officially appointed by their local authorities and it was not, therefore, possible to hold the usual Annual General Meeting in April of that year.

This unhappy situation seemed to be common throughout Divisions and it was a very wise decision of the Council of the Society to enable this difficult period of transition to be accomplished by permitting Divisional Representatives of the North East Division to continue to serve as representatives of the Northern Division until it was convenient to hold an inaugural Annual General Meeting of the new Division. No doubt in due course, when the dust of reorganisation settles, the Division will resume the battle for clean air and, indeed, recent progress in the Northern Division is very encouraging.

At the end of 1972 some 33% of the premises in the North East Division were covered by smoke control orders, whereas at the 30th June, 1974, this coverage had been increased to 39%. However, because of the new extended boundaries there must now be taken into consideration the county of Cumbria wherein relatively little progress had been made in smoke control. The addition of this new county has the effect of reducing the overall percentage of smoke controlled premises and in future, for statistical purposes, it will be necessary to operate from a new basis.

Nevertheless, despite the inevitable delays in progress created by reorganisation, the outlook for smoke control in the North East may be regarded as quite bright. As a result of the recommendations of the Clean Air Council Investigation Panel of 1972 there has been established by the Department of the Environment a Joint Clean Air Committee for the North East under the chairmanship of Councillor Mrs. J. M. Scott-Batey and on this committee your Secretary serves as a representative of our Society. The efforts of the Society, in this way, will be supplemented by this welcome official interest and the progress indicated above which has been achieved over the past two years will surely be maintained until the Northern Division achieves a satisfactory place in the clean air league table.

L. Mair
Hon. Secretary

Membership List

Sustaining Members
National Coal Board
Northern Gas

Local Authority Members
Allerdale District Council
Barrow in Furness District Council
Carlisle District Council
Castle Morpeth District Council
Chester-le-Street District Council
Durham City Council
Easington District Council
Gateshead Metropolitan District Council

Hartlepool District Council
Langbaurgh Borough Council
Newcastle Upon Tyne Metropolitan Borough Council
North Tyneside Borough Council
Sedgefield District Council
South Tyneside Borough Council
Stockton On Tees District Council
Wansbeck District Council

Corporate Members

Central Electricity Generating Board North Eastern Region
Coal Merchants Federation Northern Region
Head Wrightson Iron & Steel Works
Newcastle Regional Hospital Board
North Eastern Electricity Board
Proctor & Gamble Ltd.
University of Newcastle Upon Tyne

Individual Members

Blake, D.
Calvert, Mrs. M. R.
Carr, W.
Cayton, S.
Chambers, A.
Cosgrove, J.
Eve, Mrs. M. E.
Horn, R.
Isaac, Prof. P. C. G.
Leadbeater, Dr. B.
Learmouth, G. S.
MacMullen, A. J.
Prudham, J. P. S.
Spriggs, Dr. E. A.
Walker, A. S.
Wilkinson, J. R.
Young, B. N.

Division 4

NORTH WEST DIVISION

Chairman: L. Goodman
Hon. Secretary: W. E. Pollitt

The Annual General Meeting of the North West Division was held on 9th May, 1973, at the Pembroke Hall, Worsley, Lancashire.

Councillor E. J. Holt, Chairman of the Worsley Urban District Council and member of the North West Divisional Council, welcomed members to Worsley and said how pleased he was that the Division had decided to hold the meeting at Worsley.

The Division was honoured by the presence of Mr. W. Combey, Chairman of the National Society and Admiral Sharp, C.B., D.S.C., Director of the Society.

The meeting was attended by 150 members of the North West Division who heard Mr. John Teale speak on the new fuels and their effect on the environment, Mr. Michael Maybury on new housing development and the contribution of the gas industry and Mr. Keith Gould on central heating systems and research.

All of these gentlemen were members of the North West region of the Gas Board who entertained the members to luncheon.

The Divisional Council met on three occasions during the year. At the first meeting, Mr. R. A. W. Hollingdale of the North West region of the Gas Board, retiring chairman of the Divisional Council, installed Mr. L. Goodman of the National Coal Board as chairman for the ensuing two years. Mr. H. Clusky was elected Honorary Treasurer and Mr. W. E. Pollitt was elected Honorary Secretary of the Division.

The work of the Divisional Council has been mainly concerned with the problem of the re-organisation and its effect on the society. The delay in calling this Annual General Meeting was directly due to the changes in local government and its accompanying difficulties. In point of fact, from 1st April, 1974, Division had no council and it was only after mid-July that the pattern of local authority membership became apparent. Due to re-organisation, many familiar faces are no longer with us but we have many new members. To those ladies and gentlemen who are no longer representing their local authorities, the National Society take this opportunity of thanking them for their valued support and assistance in the field of clean air, and a warm welcome is extended to all new representatives who will provide the Society with the necessary drive and enthusiasm to carry on the work.

The Divisional Council considered the constitution of the North West Division and this will be one of the first matters the new Divisional Council will have to deal with.

In addition to the work of the Divisional Council, speakers have been provided, during the period under review, on the subject of clean air and noise control, to Ladies' Guilds, Civic Societies, Rotary Clubs, Schools and Universities. It is interesting to note that many schools are now making their pupils aware of the environment and the need for conservation. Here the Society has been able to assist.

The boundaries of the new Division encompass 56 local authorities, of which 26 are already members and it is hoped that this number will increase as local authorities catch up with the great amount of work they have yet to do. The North West Division of the Society has weathered the storm of re-organisation and now we can again move forward in the work of ensuring that we all live in a cleaner atmosphere.

W. E. Pollit
Hon. Secretary

Membership List

Sustaining Members

Mather & Platt Ltd.
National Coal Board
North Western Electricity Board
North West Gas
Shell Chemicals U.K. Ltd.

Local Authority Members

Alyn District Council
Blackpool Borough Council
Bolton Borough Council
Burnley Borough Council
Bury Metropolitan Borough Council
Cannock Chase District Council
Cheshire County Council
Delyn District Council
Fylde Borough Council
Greater Manchester County Council
Halton District Council
Hyndburn District Council
Knowsley Metropolitan Borough
Macclesfield District Council
Manchester City Council
Oldham Metropolitan Borough
Pendle District Council
Preston Borough Council
South Ribble Borough Council
Rochdale Metropolitan Borough Council
Rossendale Borough Council
Salford Metropolitan District Council
Sefton Metropolitan District
St. Helens Borough Council
Stockport Metropolitan Borough Council
Tameside Metropolitan District Council
Trafford Metropolitan District Council
Warrington Borough Council
West Lancashire District Council
Wigan Metropolitan Borough Council
Wirrall Metropolitan Borough Council

Corporate Members

Central Electricity Generating Board, N. West Region
Furness District Fed. Owner Occupiers Assn.
Greater Manchester Council for Clean Air & Noise Control
Merseyside & North Wales Electricity Board

Nailsea Engineering Ltd.
N.W. Regional C'tee., Coal Merchants Fed., G.B.
Robinson Willey Ltd.
S.E. Lancs Air Pollution Committee
Sutcliffe Speakman & Co. Ltd.
Taymar Ltd .
The Woolton Society

Individual Members
Ault, H.
Barnes, W.
Baxter, T.
Behrens, A.
Brown, P. S.
Cass, H. V., M.B.E.
Chandler, Professor T. J.
Christian, F. V.
Clusky, H.
Cooper, R. I.
Fallows, W. B
Franklin, E. J.
Franklin, N. J.
Gee, Mrs. Joyce
Gee, J.
Gibbons, E. B.
Hall, A.
Halliday, A. C.
Hallows, V. K.
Hayhurst, H.
Hayhurst, Mrs. K. M.
Heald, Dr. G. E.
Hendy, Dr. B.
Jackson, C. L.
Jewsbury, S.
Kirk, W. R.
Kitchener, Earl
Lane, Mrs. W.
Leech, Dr. P. W.
Lloyd, A.
Mason, Mrs. E. M.
Moss, D.
Pennington, H.
Pike, Miss I. M.
Poller, Mrs. H.
Pollitt, W. E.
Renshaw, T.
Richards, J. E.
Roots, D. C.
Taylor, A.
Taylor, S.
Vanstone, H. B.
Ward, A. G.
Whipder, F.
Williamson, J. G.
Winder, F.
Wood, Miss Clara

Division 5
YORKSHIRE DIVISION

Chairman: L. Eastwood
Hon. Secretary: W. B. Twyford

During the year, three meetings were held, which is a smaller number than usual.

This decrease in activity was due entirely to the commitments made on staff by the Reorganisation of Local Government and the activities of the Division were mainly concerned with the planning for the future in order to try and achieve a smooth transition after the 1st April, 1974.

Reports received from the various Local Authorities included in the Division indicated that the work of securing an improvement in the atmosphere was progressing satisfactorily and a number of Local Authorities managed to achieve the complete smoke control of their districts before the 31st March, 1974, although in many instances the operative date of the Orders will fall considerably later.

W. B. Twyford
Hon. Secretary

Membership List

Sustaining Members
National Coal Board
North East Gas
Yorkshire Electricity Board

Local Authority Members
Barnsley District Council
Bradford Metropolitan District Council
Cleethorpes District Council
Doncaster & District Borough Council
Glanford District Council
Grimsby District Council
Harrogate District Council
Kirklees Metropolitan Borough Council
Leeds City Council
North Yorkshire County Council
Rotherham Borough Council
Selby District Council
Sheffield City Council
South Yorkshire County Council
Wakefield Metropolitan District Council
West Yorkshire County Council
York City Council

Corporate Members
British Steel Corporation
Central Electricity Generating Board, North Eastern Region
Sheffield & District Clean Air Committee
John Thurley Ltd.
Yorkshire & Humberside Advisory Council For Clean Air & Noise Control

Individual Members
Armitage, F.
Ball, Miss J. D.
Bell, T. R. H.
Brett-Littlechild, R.
Brown, G. L.
Burn, Dr. A. T.
Crooker, P.
Etherington, H.
Fleming, I.
Hackney, E. S.
Haffner, A. E.
Hutton, Dr. K.
Imire, B. W.
Jones, L.
Jordan, H. H.
Laverick, P. M.
Marshall, G. C.
Miller, Dr. J. E.
Newell, R. A.
Reynolds, F.
Saword, A. C.
Saxton, W. T.
Sewell, Dr. P.
Sharp, A. I.
Slater, D. J.
Winfield, E. J.
Wraith, M. D.

Division 6
WEST MIDLANDS DIVISION

Chairman: H. E. T. Lowbridge
Hon. Secretary: D. A. Spurrier

Local government reorganisation and the consequent retirement of many officers and elected members, the disappearance of many authorities and the considerable movement of local authority staff had a drastic effect on the Divisional Council and its activities.

Two meetings of the Divisional Council were held, one at the Council House, Birmingham, when Admiral Sharp spoke about the reorganisation within the Society and the extension of its activities; the second meeting was held at the headquarters of the Midlands Electricity Board, Halesowen, when members were addressed by Mr. C. Wickstead, the Deputy Chairman of the Board, and later visited the M.E.B's Industrial Development Centre.

The Annual General Meeting was held at Chaseley Arts and Recreation Centre, Cannock, and was followed by a visit to Lea Hall Power Station, Rugeley.

Mr. H. E. T. Lowbridge was elected Chairman of the Divisional Council and Mr. A. R. Williams of L.C.P. Fuels Limited, representing the Coal Merchants' Federation, was elected Hon. Treasurer.

D. A. Spurrier
Hon. Secretary

Membership List

Sustaining Members
National Coal Board
Midlands Electricity Board
West Midlands Gas

Local Authority Members
City of Birmingham
Coventry City Council
Dudley Metropolitan Borough Council
Hereford District Council
North Warwickshire District Council
Nuneaton District Council
Rugby District Council
Sandwell Metropolitan Borough Council
South Staffordshire District Council

Staffordshire County Council
Stoke-on-Trent District Council
Walsall Metropolitan Borough Council
Wolverhampton Metropolitan Borough Council
Wrekin District Council
Wyre Forest District Council

Corporate Members
The University of Aston in Birmingham
Cradley Boiler Co. Ltd.
Guest Keen & Nettlefolds Ltd.
Lodge-Cottrell Ltd.

Individual Members
Busby, H. G. T.
Cookerham, Dr. R. G.
Cawley, Lady
Darnell, J. R.
Dingley,, Ald. W. L.
Donaldson, I. J.
Garner, W. A
Gillett, J. A.
Gittins, M. J.
Grimmett, P. H. G.
Hawksley, P. G. W.
Hockton, D.
Knightbridge, C. R.
Longley, J. C.
Lowbridge, H. E. T.
Owen, A. G.
Reynolds, K.
Roberts, R. E. J.
Scrimshaw, H. N.
Cecil Smart, R.
Steadman, A. T.
Taylor, C. B.

Division 7

EAST MIDLANDS DIVISION

Division 8

EASTERN DIVISION

Chairman: Dr. R. V. Riley
Hon. Secretary: E. F. Raven

The period covered by this report began with the threat of reorganisation becoming increasingly imminent. That it was no idle threat became evident as time went on and increasing numbers of local authority representatives sent apologies for absence from our meetings. Indeed I began to suspect that no-one dared to admit to having time for anything else and this leads me to say how valuable it was during that period to have Individual Members and Representatives of organisations outside local government forming a continuing nucleus. It was also an advantage that I myself was not directly involved in any major upheaval and thus able, so to speak, to keep at least one hand on the wheel.

Notwithstanding all this we not only maintained our meetings but in many ways had an outstanding year.

Peterborough more than maintained its reputation on 6th September, 1973, when we met to hear Professor Kenneth Mellanby, C.B.E., who spoke to us with great authority. On that occasion we had with us the Mayor of Peterborough who showed that he was well acquainted with problems of the environment and we were also honoured to have with us Mr. W. Combey, the Chairman of the Society.

At Chesterfield on 7th March, 1974, we had our last meeting before Local Government Reorganisation and on that occasion we were given a challenging address by Admiral Sharp and we also had an opportunity to discuss the National Air Pollution Survey at first hand with Mr. F. P. Williams of the Warren Spring Laboratory.

The 1974 Annual General Meeting was held in June at Hucknall by kind invitation of the National Coal Board, followed by a visit to the Nottingham combined Incineration and District Heating Scheme. The numbers of representatives from the newly-formed District Councils was most encouraging, but it was disappointing to have no-one from the six County Councils in the Division. Dr. R. V. Riley of the British Steel Corporation succeeded as Chairman of the Division and Mr. J. Jones, Chief Environmental Health Officer, Lincoln, was elected Deputy Chairman.

Representatives elected to the Council of the Society were Mr. K. Enderby, Cllr. R. S. Chamberlain, Cllr. D. F. Haynes and Mr. T. Henry Turner. Mr. R. Pane is also a member of the Council representing the Low Temperature Coal Distillers Association.

In 1973/74 the Divisional Council met twice and it was at this level that the frustrations of reorganisation were most noticeable. Nevertheless discussion ranged over spare parts and fuel supplies for coal-burning roomheaters, operating tools for solid fuel appliances, disposal of railway rolling stock and old cars, fuel supplies for the blue brick industry as well as the running of the Division and reorganisation. There has been one meeting of the new Divisional Council.

The death occurred during 1974 of Mr. John Dilworth a former Mayor of Derby and a former Chairman of the Division. Though out of Local Government since 1968, and in failing health, Mr Dilworth maintained his membership of the Society up to the time of his death.

I would record my thanks to all who have helped in any way in the running of our meetings. The enthusiasm and hard work which characterise all our visits, our Divisional Meetings and our Divisional Council Meetings are a great encouragement and, I feel, augur well for the future of the new East Midlands Division which has reformed very well indeed.

As the Society's horizons expand it is hoped to bring more local authorities and organisations into the valuable forum which it is felt the Divisional Meetings afford, and so to maintain the impetus which the Society has undoubtedly provided in the past for improvement in many aspects of the environment.

E. F. Raven
Hon. Secretary

Membership List
East Midlands

Sustaining Members
Coalite and Chemical Products Ltd.
East Midlands Electricity Board
East Midlands Gas
National Coal Board

Local Authority Members
Amber Valley District Council
Ashfield District Council
Bassetlaw District Council
Blaby District Council
Bolsover District Council
Boston District Council
Cambridge District Council
Chesterfield Borough Council
Daventry District Council
Derby Borough Council
Erewash District Council
Fenland District Council
Gedling District Council
Harborough District Council
High Peak District Council
Hinckley & Bosworth District Council
Huntingdon District Council
Leicester District Council
Lincoln County Council
Mansfield District Council
Newark District Council
North East Derbyshire District Council
North Kesteven District Council
North West Leicestershire
Nottingham City
Peterborough Borough Council
Rushcliffe Borough Council
South Derbyshire District Council
South Holland District Council
West Derbyshire District Council

Corporate Members
British Steel Corporation, Chemicals Division

British Steel Corporation, Tubes Division
Central Electricity Generating Board, Midlands Region
Dust Control Equipment Ltd.
Low Temperature Coal Distillers Association of Great Britain
National Carbonising Co. Ltd.

Individual Members
Allison, G.
Barnes, A. J.
Catlow, J.
Crowther, J. S.
Davies, D.
Drabble, G.
Ford, E. C.
Harris, T. A.
Hunt, Dr. J. .C
Jones, B. T.
McDonald, J.
Needham, C. E.
Pepperdine, E. C.
Robinson, A. Lister
Store, N. J.
Scopes, F. V.
Turner, Miss H. E.
Turner, T. Henry
Wade, A.
Waring, F. L., C.B.E.
Weldon, Miss G. M.
Wright, P. F.

Eastern

Sustaining Members
Eastern Electricity Board

Local Authority Members
Basildon District Council
Brentwood District Council
Castle Point District Council
Colchester Borough Council
Epping Forest District Council
Ipswich Borough Council
Mid Suffolk District Council
Norwich District Council
Rochford District Council
Southend-on-Sea Borough Council
Thurrock Borough Council

Corporate Members
Ford Motor Company Ltd.
Marshall & Parsons

Individual Members
Bastable, N.
Burnett, D.
Clinch, H. G.
Darby, F. M.
Dobson, P. F.
Fisher, A. M.
Goodfellow, J.
Kendall, Dr. J. D.
Oliver, G. T.
Rayner, K. F.
Roper, Capt. R.
Stephenson, Dr. R. J.

Division 9
LONDON AND SOUTH EAST DIVISION

Division 10
CENTRAL SOUTHERN DIVISION

Chairman: W. C. Combey
Hon. Secretary: B. C. Upton

The Annual General Meeting of the South East Division was held at the Friends House, Euston Road, London, on 21st March, 1974, when Mr. W. Combey was again elected Chairman. During the meeting the Chairman made a presentation to Mr. R. F. Shapter on behalf of members of the Divisional Council, and expressed grateful thanks to him for his services rendered as Hon. Secretary of the Division from 1969 to 1974. After the business meeting a talk was given by the Director of the Society, Rear Admiral P. G. Sharp, on the existing and future roles of the Society in the light of present-day circumstances together with the implications of recent and impending legislation and the reorganisation of the Society to enable it to fulfil these roles.

The normal activities of the Division have been curtailed during 1974 largely on account of the re-organisation of local government and the Society. As a result of the latter, the South East Division will become two Divisions, namely the London and South East and the Central Southern Divisions. A Divisional Council meeting was held in June to discuss this matter and it was resolved that the two new Divisions should continue to operate as one until the end of March 1975.

A Divisional Meeting was held in London during September, at which a talk on the Control of Pollution Bill was given by Mr. T. H. Iddison, Environmental Health Officer, Dartford District Council.

B. C. Upton
Hon. Secretary

Membership List
London and South East Division

Sustaining Members
British Gas Corporation
British Petroleum Co. Ltd.
British Steel Corporation
Central Electricity Generating Board
Coal Merchants Federation of Great Britain
Courtaulds Ltd.
Eastern Gas Board
Electricity Council
Environmental Protection Equipment Manufacturers' Association
Esso Petroleum Company Ltd.
Greater London Council
Imperial Chemical Industries Ltd.
National Carbonising Co. Ltd.
National Coal Board
North Thames Gas Board
Shell International Petroleum Co. Ltd.
Shell-Mex and B.P. Ltd.
South Eastern Gas Board

Local Authority Members
Barnet, London Borough of
Bexley, London Borough of
Brent, London Borough of
Brighton Borough Council
Bromley, London Borough of
Camden, London Borough of
Crawley Borough Council
Dacorum District Council
Dartford District Council
Dover District Council
Ealing, London Borough of
Eastbourne Borough Council
Enfield, London Borough of
Epsom & Ewell Borough Council
Gillingham Borough Council
Gravesham Borough Council
Greenwich, London Borough of
Hackney, London Borough of
Hammersmith, London Borough of
Harrow, London Borough of
Havering, London Borough of
Hillingdon, London Borough of
Hounslow, London Borough of
Islington, London Borough of
Kensington & Chelsea, London Borough of
Kingston Upon Thames, London Borough of
Lambeth, London Borough of
Lewes District Council
Lewisham, London Borough of
London, City of
Medway Borough Council
Merton, London Borough of
Mid-Sussex Borough Council
Redbridge, London Borough of
Reigate & Banstead Borough Council
Richmond Upon Thames, London Borough of
Runnymede District Council
Shepway District Council
Southwark, London Borough of
Surrey Heath District Council
Sutton, London Borough of
Three Rivers District Council
Tower Hamlets, London Borough of
Wandsworth, London Borough of
Watford Borough Council
Waverley Borough Council
Welwyn Hatfield Borough Council
Westminster, City of
Woking Borough Council
Worthing Borough Council

Corporate Members
Ambuco Ltd.
Asbestos Information Committee
Association of Public Health Inspectors
B.I.C.E.R.I. Ltd.

British Insulated Callender's Cables Ltd.
British Independent Steel Producers' Association
British Medical Association
Buckle, G. H. & Partners
Burmah Oil Trading Ltd.
Caltex (U.K.) Ltd.
Centri-Spray Ltd.
Charrington Solid Fuel Ltd.
Chemical Construction (G.B.) Ltd.
College of Fuel Technology
Conoco Ltd.
Drummond Dust & Fume Extractors Ltd.
Dust Suppression Ltd.
Electrical Association for Women
Englehard Sales Ltd.
Flaregas Engineering Ltd.
Ford Motor Co. Ltd.
Geldia (London) Ltd.
A. Guinness, Son and Co. (Park Royal) Ltd.
Howden Engineering Ltd.
Industrial Gas Cleaning Association
Institute of Fuel
Institution of Gas Engineers
Institute of Petroleum
John Zinc Co. Ltd.
London Electricity Board
London Trades Council
London Transport Ltd.
Metal Box Co. Ltd.
Mobil Oil Co. Ltd.
Public Road Transport Association
Radiation Ltd.
Road Haulage Association
Royal Society of Health
S.F. Air Treatment Ltd.
Solid Smokeless Fuels Federation
South Eastern Electricity Board
Sturtevant Engineering Ltd.
Sumner, G. & Partners
Women's Solid Fuel Council
Women's Gas Federation and Young Homemakers

Individual Members

Acworth, Miss E. A.
Allan, R. W.
Barrie, W. L.
Beaumont, M.
Berry, A. G.
Bond, Prof. G. G.
Bottom, D. W.
Boult, Sir Adrian C.
Bradshaw, N. F.
Brown, A. W.
Brown, H.
Buist, Commander C.
Burridge, I. G.
Butler, J. W.
Carter, Dr J. S.
Chandler, P.
Chapman, W. B.
Chatfield, A. J.
Chesney, Miss T. R.
Cleverden, Mrs. S.
Coker, W. G.
Colville, Lt. Com. R. F.
Courtier, G. B.
Craxford, Dr. S. R.
Cronk, J. J. T.
Curtis, B.
Davies, R. H.
Daynes, D. A.
East, R. G.
Eaton, Dr. F. J.
Ellis, P. T. A.
Elsworth, Mrs. F. S.
Fisher, Mrs. F.
Forrester, Dr. C.
Fowle, Lady Honour C.
Fox, Dr. R. H.
Gandy, Miss R. L.
Garland, G. E.
Gillett, T.
Gimpel, Mrs. C.
Goldsmith, A.
Grant, P. M.
Graves, T. G.
Green, J.
Greenhead, E.
Greenwood, Mrs. E. L.
Hamilton, Dr. P. M.
Hawksley, P. G. W.
Held, P. E. J.
Henson, C. G.
Hickman, Miss V.
How, M. D.
Hulme, G. H.
Jackman, F. A.
Jackson, C.
James, B. W.
Jellis, F.
Jones, D. P. G.
Jones, W. L.
Kendall, Dr. J. D.
Kirkpatrick, D. A.
Langwell, W. H
Laundon, J. R.
Lax, Mrs. G.
Lord, D. G.
Margolis, A. C
Marsden, R.
Matthews, Dr. N. E.
Medawar, Lady
Mellins, Mrs. M. H.
Menuhuin, Yehudi
Miles, S. E.
Monkhouse, Dr. A. C.
Mowle, C. R.
Nelson, Mrs. D.
O'Gilvie, A. G.
Parker, Dr. A.
Parker, Dr. R. A.
Patrick, G. M.
Pedrick, F.
Pennington, W J.
Pinguey, L.
Poole, Mrs. W. M.
Potter, Dr. N. M.
Rayner, K. F.
Rice, A. P.
Rosling, Miss E. M.
Rundle, L. G.
Saunders, Mrs. J.
Scorer, Professor R. S.
Scot, J.
Scotson, D. A.
Seale, R. J.
Shackcloth, W.
Shanks, E. C.
Shielson, Mrs. N. M.
Shillito, D. E.
Silver, O. B.
Smith, A. R.
Smith, Mrs. P.
Stephenson, Dr. R. J.
Stewart, R. E.
Stoddard, Dr. A.
Stubbs, G. C.
Thomas, F. L.
Thomas, R. B.
Todd, G. F.
Train, Dr. D.
Turner, Dr. W. C.
Vine, Mr. and Mrs. G. M.
Des Voex, Mrs. M. F.
Walker, D. M.
Watson, Professor H. E.
Webb, C. H.
Wermann, J. C.
Westbrook, J.
White, Dr. H. D. J.
White, Mrs. C. P.
Wigan, H. N.
Woldridge, K. G. W.
Yarrow, C.

Membership List
Central Southern Division

Local Authority Members

Aylesbury Vale District Council
Bedfordshire County Council
Cherwell District Council
Chiltern District Council
Fareham District Council
Gosport Borough Council
Havant District Council
Mid Bedfordshire District Council
Milton Keynes Borough Council
New Forest District Council
Oxford City
Portsmouth City
Windsor & Maidenhead
Rushmoor Borough
Slough District Council
South Bedfordshire
South Oxfordshire
Vale of Whitehorse District Council
Winchester City
Windsor & Maidenhead Royal Borough
Wycombe Borough Council

Corporate Members

Atomic Energy Research Establishment
B.I.C.E.R.I. Ltd.
Ronald Trist Controls Ltd.
Southern Gas Board
South West Electricity Board

Individual Members

Armstrong, F. W.
Bartlam, J. M.
Bradbury-Williams, J. C.
Brown, T. J.
Bryant, Miss P. M.
Combey, W.
Crosby, A. S. B.
Davies, P. M.
Dimbleby, T. E.
Gavin, M. J.
Gilbert, E. D.
Guild, J. D.
Haywood, L. H.
Hinde, Dr. P. T.
Hussey, R.
Jones, Dr. L. H. F.
Madelin, WG CDR I.
Nonhebel, Dr. G.
Parry M.
Scotson, D. A.
Shields, J.
Tagg, J. R.
Taylor, A.
Verdin, A.
Willison, Mrs. M. E.

Division 11

SOUTH WEST DIVISION

Chairman: Councillor C. Hebblethwaite, C.B.E.
Hon. Secretary: D. J. Barnett

Activities during the year in the south west have been severely curtailed because of the extra work created by the reorganisation of Local Government. However, at the beginning of the year, the Division set up a Working Party to examine the provisions in the Protection of the Environment Bill, to make recommendations about possible amendments, and to comment on any shortcomings. Detailed comments were submitted for consideration by the Society's appropriate Committees; and at the same time, the comments were circulated to all local M.P's. In the event, many of these suggestions were incorporated into the Control of Pollution Bill, although the credit for this probably lies elsewhere.

In March 1974, the Annual General Meeting was held in Bristol and the principal officers of the Division were re-elected, Councillor C. Hebblethwaite, C.B.E., of Bristol, being the Chairman, and Mr. P. Draper (Individual Member) being the Vice-Chairman. The meeting was addressed by the Secretary-General and by the Chairman of Council, Mr. W. Combey.

As has already been mentioned, Local Government reorganisation has had a significant effect upon the Division. One effect which is very welcome, is that there is now a better spread of membership throughout the south western area, although there is no representation at all from Cornwall. However, this better spread of membership does provide a more effective base for the Society's work, and it is hoped this will result in an increase in membership in due course. No meetings have been held since the Annual General Meeting but the normal full programme for 1975 will be followed.

The reorganisation of the Society itself has resulted in an increased involvement of the Division in the affairs of the Society, there now being three representatives of the Division on the Council instead of the one as hitherto.

D. J. Barnett
Hon. Secretary

Membership List

Local Authority Members
Bath City Council
Bristol Borough Council
Cheltenham District Council
Devon County Council
Exeter City Council
Forest of Dean District Council
Northavon Borough Council
Plymouth City Council
Salisbury District Council
Taunton Deane District Council
Thamesdown District Council
Torridge District Council
Wansdyke District Council
Woodspring District Council

Corporate Members
Burmah Oil Trading Ltd.
Central Electricity Generating Board, S.W. Area
South Western Electricity Board
South Western Gas
Wilson & Partners

Individual Members
Archard, P.
Barnett, D. J.
Blampied, F. C.
Colehan, J. E.
Crook, S. C.
Davies, R. H.
Draper, P.
Freeland, Miss E.
Harris, J.
Holroyd, P. M.
Hookin, Dr. L. E., O.B.E.
Kenney, J. C.
Lane, Dr. J. J.
Thomas, L. C.
Trevillion, Mrs. F.
Wakeley, R. W.
Wallis, Mrs. E.
Watkins, E. R.
Whiting, G. C.
Whittle, E. G.
Williams, J. R.

Division 12
SOUTH AND MID WALES DIVISION

Chairman: To be announced
Hon. Secretary: L. Morgan

No meeting of the Division has been held during the last year. This, in the main, was due to the problem of local government re-organisation.

Since April the new district authorities have been joining the Society but at a slow rate. The Annual General Meeting will be held in the near future in order to confirm the new constitution, this has been made necessary due to re-organisation and to appoint its appropriate officers.

It is appropriate at the time to extend the grateful thanks of the Division to the retiring Chairman, Mrs. P. M. Mainwaring, J.P., who will not be seeking re-election. Mrs. Mainwaring has been a stalwart member of the Division for the last six years. She has always keenly interested herself with pollution problems and indeed, served as a member of the Clean Air Council for a number of years. Her wise counsel and wisdom will be sadly missed.

L Morgan
Hon. Secretary

Membership List

Sustaining Members
National Coal Board

Local Authority Members
Afan District Council
Blaenau Gwent District Council
Cardiff City Council
Cynon Valley District Council
Monmouth District Council
Neath District Council
Newport District Council
Preseli District Council
Rhymney Valley District Council
Swansea City Council
Taff Ely District Council
West Glamorgan County Council

Corporate Members
British Steel Corporation
Central Electricity Generating Board S.W. Region
Coal Merchants Federation of Wales (Eastern Area)
Coopers Mechanical Joints Ltd
S. Wales Electricity Board
Wales Gas Board

Individual Members
Brownrigg, M. A.
Dearden, Mr. and Mrs. J.
Emmett, E. E.
Harrop-Griffiths, H.
Heycock, I. G.
Roach, J. A.
Steer, J.

National Society for Clean Air

ANNUAL REPORT AND ACCOUNTS

Year Ending, 31st March 1974

Clean Air Progress

The year under review has been an interesting and busy one for the Society, but perhaps more important, it has been an important and constructive one for clean air. Last year Mr Cayton my predecessor, was able to say in his report that 1972 had provided a vintage year for smoke control orders. This impetus continued and from April 1, 1973 to March 31, 1974 no less than 346 smoke control orders were confirmed for England, Wales, Scotland and Northern Ireland.

Although such rate of progress is unlikely to be maintained because of the recent upheaval in Local Government administration, it seems clear that there is throughout the country a genuine interest in pollution control measures and a desire by those authorities having smoke control programmes to complete them as soon as possible. Indeed some 'black' authorities have now completed their original programmes and more will do so as each month passes. It seems inevitable therefore that the number of smoke control orders submitted and confirmed will gradually drop.

Over the years it has become clear that there is now no longer any need to differentiate between the so-called 'black' and 'white' areas. This has been discussed recently by the Clean Air Council and the Department of the Environment and in view of some of the anomalies resulting from the re-organisation of local authorities and re-drawing of boundaries it has been decided that the distinction will no longer be applied.

Some authorities, previously 'black' now find themselves part of a new 'white' authority and vice versa. Others having completed their original programme now find that they are absorbing or amalgamating with districts having made little or no progress at all in smoke control measures. Conversely cases occur where districts which have barely made a start or may have only paid lip service to Smoke Control in the past now find themselves allied to areas with fully completed programmes. Accordingly it seems clear that a lot of record sorting will be required in early course and the decision to abolish the designations 'black and white' appears fully justified. This state of affairs has been appreciated by the Department of the Environment which is taking appropriate steps.

As forecast last year, legislation has now been introduced to control emissions from new motor vehicles on our roads. It is early days yet to try and assess what effect this will have because so far the legislation applies only to petrol-engined vehicles first used on or after October 1, 1973. Nevertheless we consider that this legislation is a step forward and can only have good effect in the years to come.

The Society

The Society may be said to have had a busy and successful year. Membership has shown a slight increase, but what is perhaps more important, there have been no substantial losses. Financially, as the balance sheet shows, the Society is in a reasonably strong position, notwithstanding the fallen values of our reserves because of recent market trends.

Annual General Meeting

The Society's Annual General Meeting was held on Tuesday, June 26, 1973, at the Connaught Rooms, London. The meeting was well attended and the Agenda dealt with in a business-like and expeditious manner. The Annual Report and Accounts were accepted and Mr Stanley E. Cohen, C.B.E., C.C., F.R.S.A., the retiring President, invested our new President, Mr. H. B. Greenborough, the Managing Director and Chief Executive of Shell Mex and BP Limited, with the chain of office.

The Annual Public Meeting followed the business proceedings and was also very well attended. The main event was the presentation of the Arnold Marsh Clean Air Awards to Dr. Gordon Nonhebel, Dr. Albert Parker, The Corporation of London, The City of Salford, The City of Sheffield, The British Petroleum Company Limited and the Central Electricity Generating Board. The Society was indeed fortunate that Mrs. Doris Marsh, the widow of the late Arnold Marsh after whom the Awards had been named, was able to come and present the Awards in person. This was very much appreciated by the recipients and all members present.

Following the presentation of the Awards the new President, Mr. H. B. Greenborough, addressed the meeting. His address, which took the form of a stocktaking of the present position, was reproduced in full in the autumn 1973 issue of *Clean Air*.

The Annual Luncheon held after the Public Meeting was a very happy and enjoyable occasion. The President, Mr. H. B. Greenborough, proposed a toast to the guests on whose behalf the reply was made by Alderman Mrs. Patience Sheard, C.B.E., of Sheffield.

Annual Conference, Torquay

The Annual Conference was held at Torquay from the 15th to the 19th October. Although somewhat unlucky with weather conditions they did not interfere with any of the Conference activities. Happily, reasonable weather prevailed throughout the Technical visits and social arrangements on the Wednesday afternoon. Conference was very well attended, there being an increase in the number of full-time registrations over that of the previous year. All sessions were well supported, papers presented were of a very high order and discussions generally showed considerable interest in the subjects covered.

There was notable success in continuing the experiment of reducing the number of papers at the sessions with increased participation and good attendances daily.

The Conference was opened on the Monday evening, and this, despite very heavy rain, proved a happy idea, the Town

Hall at Torquay being comfortably full to hear a welcome from the Mayor of Torquay, Councillor D. G. Damerell, the Opening Address by Mr. Donald Davies of the National Coal Board, and the Presidential Address from Mr H. B. Greenborough. The Conference was to have been opened by Mr. Derek Ezra, the Chairman of the National Coal Board, but very unfortunately Mr Ezra was taken ill shortly before the opening date, and had to cancel all his engagements. His place was taken by Mr. Donald Davies who stepped into the breach at short notice and got the Conference off to a very good start. The full text of his address was published in the winter 1973 issue of *Clean Air* as was the very fine Presidential Address given by Mr. Greenborough.

On Tuesday morning, a comprehensive review of Smoke Control progress was given by Mrs. A. Moss of the Department of the Environment, and this led to a vigorous and lively discussion which gave rise ultimately to a resolution for consideration by Conference at the last session on the Friday morning. This was in fact passed in the following terms: "That this Clean Air Conference being satisfied that the definition ' black areas ' is out-of-date and that air pollution by smoke is more related to population than to industrialisation, urges H.M. Government to:

(a) abandon the concept of ' black areas ';

(b) encourage vigorously all local authorities to promote smoke control areas without restrictions."

The pattern of previous years was followed on Tuesday afternoon in taking the form of an open session organised by the South West Division. The Chair was taken by Alderman C. Hebblethwaite, CBE, Chairman of the Division, the principal speakers being Lady Sayer, Past Chairman of the Dartmoor Preservation Association and Mr Phipps Turnbull, the Devon County Planning Officer. Lady Sayer spoke of the necessity to preserve the amenities of Dartmoor and Mr. Turnbull presented a point of view that the South West was an area which was developing rapidly and would need better roads and transport facilities with all that these implied. An interesting discussion followed but unfortunately Lady Sayer had to leave early and so was unable to hear all the various comments.

Problems involving Grit and Dust were fully discussed at the next session following an excellent paper by Messrs. K. Darby and K. R. Parker which drew attention to the many technical matters involved in dealing with nuisances arising from both Combustive and Non-combustive sources.

Pollution in Cities and Health Hazards were both given full discussion in the Thursday sessions after papers by the Planning Director of Liverpool, Mr F. J. C. Amos and Dr. R. Murray of the Trades Union Congress, while Agricultural Aspects of Pollution received well merited attention at the last session of a very successful conference with contributions by a group of scientists covering Effects of Pollution on Farm Animals, Pesticides on Soil Life and Nitrates on Farm Animals.

Following the varied programme of events organised for the Wednesday afternoon period I was happy and privileged to receive and entertain many Society friends at a reception in the Grand Hotel on the Thursday evening immediately before what proved to be a very successful and enjoyable Conference Dinner and Dance.

Clean Air Spring Seminar, 1973

The second Clean Air Spring Seminar was held at the Assembly Room, Town Hall, St. Aldates, Oxford, on the 3rd to the 4th April, 1973. The Seminar was opened by the Lord Mayor of Oxford, Alderman A. B. Conners, on the Tuesday morning and this opening ceremony at which the President of the Society, Mr. Stanley E. Cohen, CBE, took the Chair, got the Seminar off to a good start.

The first paper presented by Mr. C. L. Goodacre, Consultant Engineer, on "Lead in Petrol—is it necessary?" proved most provoking and a very lively discussion followed. The second part of this first session was taken up by a panel ready to answer questions on "Acceptable Devices for the Control of Emissions". On this panel were Mr J. H. Alden of Vauxhall Motors, Dr. J. H. Weaving of British Leyland, Mr. George Donald of the Department of the Environment, Mr. Charles Goodacre and Dr. J. Ellison of the Medical Research Council.

The second session on the Tuesday afternoon was concerned with diesel engines. Mr. N. M. F. Vulliamy of Perkins Engines presented a paper on "Why do Diesels make Smoke—How may it be abated?" He was followed by Mr. Philip Draper on "Regulations Regarding Smoke Emission: Are they adequate? How can they be strengthened" This proved to be an extremely useful session at which there was a very balanced discussion.

The session on Wednesday morning dealt with gas turbines and jet engines and papers were given by Mr. M. R. Williams of Rolls Royce (1971) Limited, Bristol Engine Division and Mr. M. A. Stokes of the Industrial and Marine Division of Rolls Royce. The final session on the Thursday afternion took a general look at the future when Dr. C. G. Williams of Ricardo and Company presented a paper on "The Future: Alternative Power Plants for the Motor Car—or Alternative Fuels" This very far ranging paper provoked a great deal of discussion but left one with little doubt that the motor car, as we know it, was likely to be with us for some considerable time to come.

This Seminar was in some ways a new departure in that it was residential and delegates were accommodated very comfortably at St. Hilda's College, Oxford. There was an attendance of some 110 delegates, all sessions were full and discussion was lively.

Clean Air Spring Seminar, 1974

The Third Clean Air Spring Seminar was held at the Hallam Tower Hotel, Sheffield from 26th to 28th March, 1974. In all there were 135 registrations and the Sessions were also attended by a small number of students from Sheffield University for whom special arrangements were made. The Seminar was opened on the morning of Tuesday, 26th March, by the Master Cutler, Mr. Kenneth Lewis and that evening all delegates and authors were entertained to dinner in the Cutlers' Hall by the Lord Mayor of Sheffield.

The theme of the Seminar was "Clean Air in Sheffield—a Steel City". The scene was set at the first session when Mr. A. W. Maule, the Senior Adviser to the Sheffield and District Clean Air Committee presented a paper on "The History of the Campaign Against Air Pollution in Sheffield and District" and showed the film "Clean Air City" made by the City of Sheffield. Mr. J. H. Flux, the Divisional Manager for Environmental Pollution Control, British Steel Corporation then presented a paper on "Atmospheric Pollution Control of the Iron and Steel Industry". The afternoon of the first day was taken up with technical visits to a number of steel works in the Sheffield area where delegates were able to see for themselves some of the actual processes already discussed and which were likely to be discussed at other sessions.

The second session on the Wednesday morning dealt more specifically with some of the problems encountered. Mr. I. C. Ross, the Technical Divisional Manager at the British Steel Corporation, Rotherham Works, presented a paper on "The Development of Fume Cleaning Plant for the Templeborough Electric Melting Shop" and Mr. A. N. Howard, the Environmental Control Engineer of British Acheson Electrodes Limited presented a paper on "Environmental Control in the Manufacture of Artificial Graphite". A further paper was given by Dr. P. B. Simpson, the Regional Industrial Gas Manager of East Midlands Gas on "The Use of Natural Gas in Industry and its contribution towards Cleaner Air". The afternoon was again taken up with technical visits. Visits were made to three British Steel Corporation Works and to British Acheson Electrodes Limited.

On the morning of Thursday, 28th March, Mr. J. G. S. Smith, of the National Coal Board, Yorkshire Sales Region, presented a paper on solid fuel and Mr. M. F. Tunnicliffe, HM Deputy Chief Alkali and Clean Air Inspector, gave a paper on "The Contribution of the Alkali Act". This was followed by a very interesting paper given by Mr. T. W. Raven of the Yorkshire River Authority and Yorkshire Water Authority on "River Pollution Prevention and its Relationship with Atmospheric Pollution".

At the final session on the Thursday afternoon Dr. A. B. Hedley of the University of Sheffield presented a paper prepared by himself and Professor J. M. Beer on "The Reduction of Combustion Generated Air Pollution". Then followed a general discussion of all the various points raised at the Seminar.

This proved to be an extremely interesting Seminar at which there was some very informed and well argued discussion.

Annual Conference of the Scottish Division

The Scottish Conference was held in Edinburgh on 23rd, 24th and 25th May, 1973. The Conference opened with the Annual General Meeting of the Division on the Wednesday evening. On the morning of Thursday, 24th May, an address was given by Mr. J. B. Beaumont, the Under Secretary of the Scottish Development Department, and delegates were welcomed to Edinburgh by the Lord Provost. This was followed by an open session with a panel answering questions on clean air and the part played by local authorities.

On the Thursday afternoon, following a paper on the future of solid smokeless fuel by Mr. H. Giblin of the Solid Smokeless Fuels Federation, delegates were able to visit the plant of Scottish Rexco Limited at Comrie Colliery in Fife. In the evening the Lord Provost and Magistrates of Edinburgh entertained delegates to a buffet supper in the City Chambers.

On the Friday morning Mr. K. S. Dunn of the Incinerator Company Limited presented a paper on "Toxic Waste Incineration" and Dr. H. N. M. Stewart of Warren Spring Laboratory, spoke on "The Measurement of Road Traffic Pollution in City Streets". The Conference closed with a luncheon given by the Scottish Division.

As ever, this Conference was well attended and again showed that it is an important event in the clean air calendar.

Third International Clean Air Congress

The Third International Clean Air Congress was held at Dusseldorf from 8th to 12th October, 1973. The Congress was attended by some 1,500 delegates from 42 nations. Over a period of four days 180 papers were presented and discussed at four simultaneous sessions almost all of which were well attended. Many of the papers presented had good scientific value though some of the information contained therein had already been published elsewhere. Nevertheless, one pleasing feature was the number of papers presented by younger people of all nationalities.

The Congress was opened on the morning of Monday, 8th October, by Herr H. D. Genscher, the Minister of the Interior for the Federal Republic of Germany. That afternoon the first of the 28 technical sessions opened and these sessions continued until mid-morning on Friday, 12th October, when at the closing session the Congress was wound up by Professor Dr. Ing. Heinrich Schackmann, the President of the International Union of Air Pollution Prevention Associations.

Great Britain contributed six papers although more had been submitted originally and it was perhaps unfortunate that the International Committee decided to omit some papers which the National Committee had thought very worthy of presentation.

An interesting feature of the Congress was the "Information Show" for children specially arranged and sponsored by the German Government. This exhibition, using every known audio and visual aid, showed the dangers of noise and of pollution of air, water, sea and land, and possible cures.

In addition to the programme of technical sessions there was the usual social activity with events to suit all tastes, and perhaps one of the most interesting features was the special trip arranged by river steamer through the heart of the industrial Rhineland. Here it was possible to see not only industry working at its full potential, but also to see pollution, to smell it, taste it and actually hear it! It served as a salutary reminder that the main task for us all is to clear up such pollution. Technical papers which might be described as 'more and more about less and less' are all very well and are very necessary—but the main concern is still that more effort should be put into clearing up pollution. The danger sometimes with International Congresses such as this—is that often the wood cannot be seen for the trees!

Concurrently here with the Congress was Envitec '73, a vast international exhibition covering all aspects of control of pollution and the preservation of the environment. The British Joint Venture Stand was sponsored by the Society and some twelve firms and organisations were represented. The exhibition was visited by most of the delegates and by a reasonable number of the general public and the British Stand received a fair measure of support. The information section, which was manned by staff of the Society, was kept very busy in providing information about the control of pollution in the United Kingdom and in distributing pamphlets and selling publications.

The Council and its Committees

The Council and its Committees met regularly throughout the year. At its first meeting the Council elected me to the office of Chairman which I was both happy and proud to accept. In accordance with the new policy of the Society the post will be occupied for one year with one year following as Immediate Past Chairman. This gives opportunity for more members to share in high office and so stimulate interest in the progress of the Society.

The Conference and Publicity Committee has had a very full year in preparing programmes for the Conference in Torquay, the Spring Seminar in Oxford and the Spring Seminar in Sheffield. It has also been concerned with the programme for the forthcoming Conference at Cardiff and the subsequent International Conference to be held at Brighton in 1975.

The Technical Committee has been very concerned with the question of emissions from the exhausts of motor vehicles and following the publication of the pamphlet on sulphur dioxide is now engaged in the preparation of a pamphlet about exhaust fumes from motor vehicles and the preparation of a glossary of terms used in air pollution and its control.

The Parliamentary and Local Government Committee have also had a full programme. They have been concerned with such matters as the sheeting of lorries, stone cleaning by the dry process and burning on demolition sites. They have been in constant touch with the Department of the Environment on these matters and about the disclosure of information regarding industrial emissions. This matter was raised originally by the Society with the Clean Air Council and also subsequently by the Royal Commission on Environmental Pollution. As a result of this the Secretary of State appointed a working party under the aegis of the Clean Air Council to investigate and report on the whole matter. The Director of our Society was appointed Chairman of this Working Party and several members of Council served upon it. The report of the Working Party was made in the middle of 1973 and the Government decided to accept many of the suggestions made and incorporate them in a new Protection of the Environment Bill. Unfortunately, the Bill which was introduced into the House of Lords just before the General Election, fell as a result, but it is understood that the present Government intend to re-introduce the Bill very shortly.

The General Purposes and Finance Committee has been fully engaged on the extremely important work of finance and day-to-day management of the Society. Last year—together with the Reconstruction Sub-Committee—it had been very busy preparing recommendations regarding the future of the Society. These were circulated to all divisions for comment before being further considered by the Committee. The Committee as a result recommended a number of alterations to Council which were thoroughly debated in June, 1973, before Council decided that the Society should try to extend its Terms of Reference. These would embrace such matters as were appropriate in the context of Air Pollution, involving noise as a pollutant and, pollution of land and water so far as they affect clean air or are affected by air pollution.

It was agreed that the Council of the Society should be enlarged in order to ensure balanced representation of all types of membership of the Society, i.e., Local Authorities, Industry, individual members and the Divisions of the Society. Consideration was also given to Boundary revision for some Divisions have tended to grow too large and with the re-organisation of Local Government there was an admirable opportunity for action in respect of new boundaries. There was also concern felt by Council at subscription rates in the light of rising prices and rapid inflation, for subscriptions must be kept in step with modern conditions.Elections were also important for hitherto they had been carried out by postal ballot from headquarters, which was to a great degree impersonal. Local elections were therefore to be carried out by divisions in future so that the action was closer to the members themselves and likely to provoke greater local interest.

These changes have made it necessary to bring up to date the Memorandum and Articles of Association and also the Byelaws of the Society.

This considerable undertaking has now been completed and three special resolutions needed thereby were put to an Extraordinary General Meeting of the Society held in the Friends Meeting House, Euston Road, London on 29th March, 1974, and carried unanimously.

As a result, the Society does not need to change its name but is now assured of wider terms of reference. It will have a larger Council at which all Sections and Divisions of the Society will be better represented. Some divisional boundaries have been revised to meet changes in Local Government areas and responsibilities. The Byelaws have been revised to introduce more realistic rates of subscription and to make provision for student membership while also recognising the need to provide for older members with a scheme of life membership. I commend these changes to you as I feel sure they will be to the benefit of the Society and enable it to fulfil its role better in modern conditions and in the years to come.

The Divisions

The Divisions, despite impending changes and the inevitable effects of Local Government reorganisation, have continued to be active, although with a reduced number of meetings. Reports have appeared in the various editions of *Clean Air* and in the *Clean Air Year Book*. The Council hope that all Divisions will now be able to resume full activity in pressing local councils to support our work in the atmosphere of modern government administration, for there is urgent need for action against all forms of pollution in the light of amalgamations of districts having in the past various and differing attitudes to pollution problems. There is a challenge to more positive action in the field of environment which must be accepted with the broader terms of reference under which we now operate and which are so important in the context of clean air.

Publicity and Public Relations

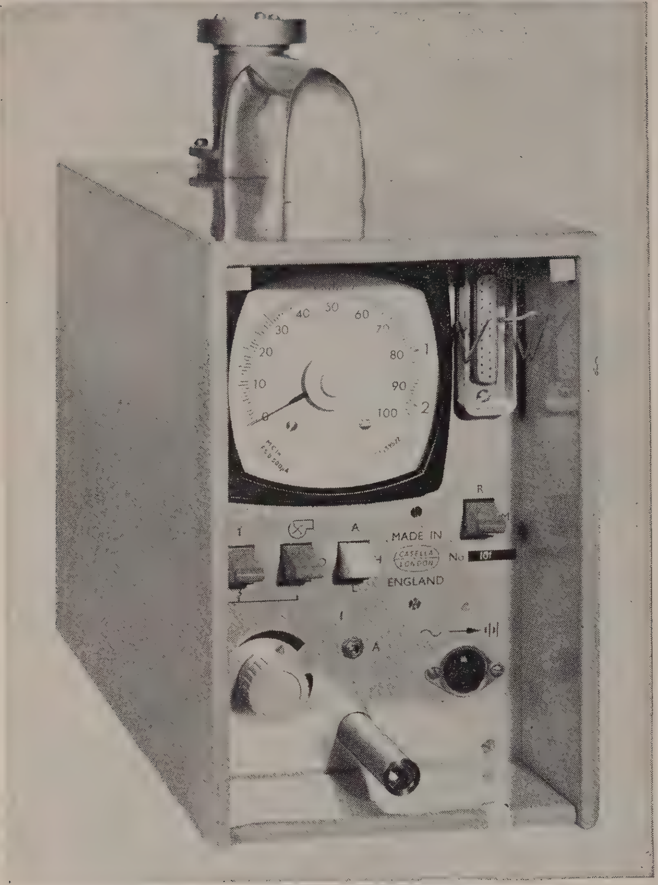
Requests for assistance from both library and information department have continued at a very high level involving universities, industry, schools and colleges. There has been a marked increase in the requests for information from schoolchildren, and to meet this demand the Conference and Publicity Committee have prepared a special pamphlet on pollution. This pamphlet has been aimed at older children. An outstanding effort by the boys of the Sixth Form of King Alfred School, Wantage, raised a considerable sum of money on behalf of the Society and this money has been devoted to a wide distribution of the pamphlet.

At the same time it is realised that another suitable pamphlet is required for younger children and this is in the course of preparation. Notes for Teachers and similar publications are also being revised to bring them up-to-date and in line with current thinking.

Members of the Society and staff have presented a number of papers at Conferences concerned with the environment and the Society has had small exhibition stands at some of them. In addition members of the Society and staff have made broadcasts at local radio stations and on the national networks.

Other Activities

The Society has continued to be involved with clean air at Government and other similar levels. We continue to be well represented on the Clean Air Council by the President, Mr. H. B. Greenborough, by the immediate Past President, Mr. Stanley E. Cohen, Commander Buist, Mr. T. H. Iddison, Professor R. S. Scorer, Mr. R. W. C. Wheatley and the Director. Members of the Society have served on the Working Party on the Disclosure of Information Regarding Emissions to Atmosphere; others are members of the Working Parties on the Suppression of Odours from Offensive and Similar Trades, and on Grit and Dust Emissions from Combustion Processes, while Mr. Philip Draper continues as a member of the appropriate committee of the British Standards Institution concerned with exhausts from diesel engined vehicles. The Society also continues to have strong representation at the Standing Conference of Cooperating Bodies.



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CA 33

Staff

Mrs. Christine Smith left the service of the Society in May, 1973, and her place was taken by Mrs. Dorothea Bornemann. Miss Patricia Robson left in July, 1973, and was succeeded by Mrs. Carol Farrow, an existing member of the Staff, whose previous duties have been undertaken by Mrs. Eileen Tribble. Mrs. Suzanne Martin left in December and her place has been taken by Miss Sian Linnette.

Financial Trends

Last year Mr. Cayton, my predecessor, was able to say that as a result of efforts made during the previous twelve months a downward trend in the finances of the Society had been checked. It is now pleasing to record an upward tendency in our income records which marks a successful year's activity. Nevertheless there is no room for complacency as a difficult phase now exists with the inevitable effects of change in Local Government already referred to.

This resulted in all 507 Local Authority members of the Society ceasing to be members on 31st March, 1974. Re-assessment of the position and recruitment of all Local Authorities was required for the new period commencing 1st April, 1974. It must be our aim to secure every Local Authority in the country as members of our Society, but we are under no illusions that this will be easy or quick to achieve. Every member of the Society will need to do their part in trying to bring this about.

Conclusion

The Society has undoubtedly had a very active and important phase of operations during the last two years or so and much credit is due to the Director and Staff for coping with demands on their services throughout this trying period. Members of Council and Committees have also borne a heavy burden and without their collaboration the Society would not be recovering so well from a period of concern and despondency. My colleague Honorary Officers have supported the Chair nobly on all occasions and I am deeply grateful to them.

In addition to the organisation of an Annual Conference and two Seminars, which reflect great credit on the Chairman and members of the Conference and Publicity Committee as well as Staff, the Society was concerned with the International Conference in Dusseldorf, while the Scottish Division organised yet another Conference with great success.

At the same time it should be realised that the whole of the work involved in reconstructing the Society and seeking anew the Local Authority membership proceeded without remission. This meant increased work load for staff and extra calls on members of Committees and Honorary Officers. To them all I would personally offer my gratitude for loyal and continued support throughout the past year. The General Purposes and Finance Committee is not unmindful of the situation and is currently investigating the situation with a view to dealing with any problem which might arise. We were able in the past to suffer some reduction in staffing which helped in a difficult period so far as finance was concerned, but the time now seems imminent when some consideration may be needed to re-assessment of staffing needs.

The work accomplished during the past year has I feel sure set the foundations of the Society firmly for a number of years and we should be able to build securely on them and look forward to wider horizons wherein may lay even greater opportunities for successful accomplishment of our aims in the realm of clean and pollution-free air.

W. Combey,
Chairman.

THE NATIONAL SOCIETY FOR CLEAN AIR
(Company Limited by Guarantee—Incorporated January 1, 1958)
BALANCE SHEET AS AT MARCH 31, 1974

		31.3.74		*31.3.73*
	£	£	£	£
FIXED ASSETS (See Notes to Accounts Nos. 1 & 2)				
OFFICE MACHINES AND FURNITURE				
As valued by the Secretary General as at 1.4.72	1,910		*1,910*	
Additions at Cost	4,180		*2,036*	
	6,090		*3,946*	
Less Depreciation (over 5 years)	2.006		*789*	
		4,084		*3,157*
LIBRARY BOOKS				
At Nominal Value		100		*100*
		4,184		*3,257*
INVESTMENTS AT COST (See Note 3)				
Fixed Interest Stocks	3,270		*3,270*	
Ordinary Shares	9,253		*9,253*	
		12,523		*12,523*
CURRENT ASSETS				
Stock of Publications at Secretary General's Valuation	1,100		*1,175*	
Sundry Debtors	4,011		*3,520*	
Prepayments	38		*1,672*	
Bank Balances	13,750		*4,964*	
Cash in Hand	44		*38*	
	18,943		*11,369*	
LESS CURRENT LIABILITIES				
Sundry Creditors and Accrued Expenses	5,993		*4,967*	
Net Current Assets		12,950		*6,402*
Net Assets		£29,657		*£22,182*
Represented by:				
GENERAL FUND				
Balance at start of year		20,104		*12,280*
Valuations as at 1.4.72—				
Office Machines and Furniture		—		*1,910*
Library Books		—		*100*
Surplus for the year		4,475		*5,814*
Balance at end of year		24,579		*20,104*
PREMISES FUND—brought forward	2,078		*78*	
Add Transfer during year	3,000		*2,000*	
		5,078		*2,078*
		£29,657		*£22,182*

Notes 1 to 6 form part of these Accounts.

W. C. Turner, M.D. *Honorary Treasurer*
P. G. Sharp *Secretary General*

NOTES TO THE ACCOUNTS

1. *Lease*
The Society bought the lease of its Brighton offices (which is for 14 years from November 15, 1965) and the cost of £2,000 was deducted from the Premises Reserve Fund.
2. *Office Furniture and Equipment*
Records are not available to show the original cost of all furniture and equipment which was valued by the Secretary General as at 1.4.72 at £1,910 and had been included in the accounts at this figure. The valuation and subsequent purchases are being written off over 5 years.
3. *Investments*
The market value of the Society's Investments as at March 31, 1974 was £14,265 compared with £20,595 as at March 31, 1973, a decrease of £6,330.
4. *Surplus on Conference and Seminars*
The Expenses deducted from the income do not include Salaries and General Expenses.

5. *Commitments*
The Society was at March 31, 1974 committed to the publication of two issues of 'Clean Air' at an approximate cost of £2,000.

6 *Divisions*
The 10 Divisions of the Society hold balances for local administration purposes which are not brought into these Accounts.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED MARCH 31, 1974

	Year 1973/74 £	£	*Year* *1972/73* £	£
INCOME				
SUBSCRIPTIONS AND DONATIONS		21,246		*22,596*
SURPLUSES ON CONFERENCES AND SEMINARS (see Note 4)				
Conference—Torbay		8,546		*7,180*
Seminars—Oxford		571		—
Sheffield		2,566		—
Manchester		—		*134*
Envitec 1973 (Germany)		71		—
Milan 1971 Conference and Joint Venture		—		*(123)*
SALES OF PUBLICATIONS		3,089		*2,992*
INVESTMENT INCOME				
Dividends (Gross)	1,095		*1,005*	
Bank Deposit Interest	978	2,073	*183*	*1,188*
		38,162		*33,967*
EXPENSES				
RUNNING COSTS				
Salaries and Wages	14,489		*12,644*	
Staff Pension Scheme	965		*825*	
Rent, Rates, Light and Heat	1,542		*1,594*	
Insurance, Travel, Cleaning and General Expenses	4,325		*3,631*	
Depreciation: Office Equipment and Furniture	1,217		*789*	
Stationery Supplies	988		*840*	
Provision for Doubtful Debts	1,372		*150*	
	24,898		*20,473*	
CLEAN AIR AND YEAR BOOK				
Printing, Postage, etc.	7,117		*7,797*	
Less Advertising Receipts	2,791		*4,060*	
	4,326		*3,737*	
INFORMATION, PUBLICITY SERVICES AND COST OF PUBLICATIONS	1,161		*1,477*	
DIVISIONAL GRANTS (See Note 6)	302		*466*	
	1,463	30,687	*1,943*	*26,153*
EXCESS OF INCOME OVER EXPENDITURE		7,475		*7,814*
LESS TRANSFER TO PREMISES RESERVE		3,000		*2,000*
BALANCE TRANSFERRED TO GENERAL FUND		£4,475		*£5,814*

REPORT OF THE HONORARY AUDITORS OF THE NATIONAL SOCIETY FOR CLEAN AIR

We have examined the Balance Sheet and annexed Income and Expenditure Account. In our opinion the Accounts comply with the Companies Act, 1948 and 1967 and give a true and fair view of the state of the Society's affairs at March 31, 1974 and of its surplus for the year ended on that date.

City Gate House,
39/45 Finsbury Square,
London EC2A 1AE.
April 27, 1974

GEO. LITTLE, SEBIRE & CO.,
Chartered Accountants

SECTION 2

AIR POLLUTION

Page

An Outline of the Law Relating to Air Pollution 24

The Ringelmann Chart 45

British Standards Relating to Air Pollution 47

Glossary of Terms Relating to Air Pollution 50

Estimates of Air Pollution in the United Kingdom in the year 1971/2 .. 63

Estimates of Air Pollution in the United Kingdom in the year 1972/3 .. 64

Comparison of Air Pollution Statistics 66

Smoke Control Areas 69

The History of Air Pollution and its Control in Great Britain 74

Major Smog Disasters 75

The Clean Air Case 76

The Cost of Air Pollution 77

AN OUTLINE OF THE LAW RELATING TO AIR POLLUTION

The control of air pollution in Great Britain is essentially a team effort involving Local Authorities, the Department of the Environment (including the Alkali Inspectorate), Police Authorities (in respect of road vehicle emissions) and the Factory Inspectorate (in respect of dusts and toxic fumes, etc., in factory atmospheres).

The principal legislation enforced by local authorities in Great Britain (excluding Northern Ireland) is contained in the Clean Air Acts 1956 and 1968, but some of the "nuisance" provisions of the Public Health Act 1936, extended and amended by the Public Health Act 1961 and the Public Health (Recurring Nuisances) Act 1969, are applicable in specified circumstances. Part IV of the Control of Pollution Act 1974, when operative, will further extend and modify Clean Air legislation in several ways. The domestic smoke control area provisions of the Clean Air Act 1956 were amended by Section 95 of the Housing Act 1964 and further amended by the Clean Air Act 1968.

Additionally, Local Authority Clean Air enforcement work may be influenced by the far reaching provisions of the Health and Safety at Work Act 1974, when regulations under that Act are promulgated.

The provisions of the Clean Air (Northern Ireland) Act of 1964 are largely identical to those of the 1956 Act.

The control of "noxious or offensive gases" from some 59 different classes of works registrable under the provisions of the Alkali &c. Works Regulation Act 1906 and the Alkali &c. Works Order 1966 is exercised by the Alkali Inspectorate of the Department of the Environment (see the section on page 40 on the Alkali &c. Works Regulation Act).

Action may also be taken under Common Law procedure by anyone who suffers nuisance from air pollution, and in this way it may be possible to secure damages and/or to obtain an injunction.

There are also a number of Private Acts of Parliament in which some local authorities possess powers to deal with smoke emission, to establish smokeless zones and to grant optional prior approval of proposed new industrial fuel burning installations. Most of these provisions, although they may remain in force, have now been superseded by the provisions of the Clean Air Acts 1956 and 1968. The control of pollution from road vehicles is exercised by the police under the provisions of the Road Traffic Acts and the Motor Vehicles (Construction and Use) Regulations 1969, a note of which is to be found on a later page.

The following outline of current legislation, which necessarily omits much detail, gives the main provisions of the Clean Air Acts 1956 and 1968 and supporting Acts under the main subjects of "smoke", "chimney heights", "grit, dust and fume" and "miscellaneous provisions".

At the time of preparation of these notes, it would appear that the economic situation might delay the operation of most of the Control of Pollution Act 1974. Rather than preparing a complete revision for the 1975 Year Book, those sections of the current legislation likely to be modified or repeated by the Control of Pollution Act are marked with an asterisk (*) and the note "modified by CPA 1974".

1. THE CONTROL OF SMOKE

A Definition of "dark" and "black" smoke:

Where legal standards of emission are prescribed for smoke, they refer to "dark" and "black" smoke. These are defined in the 1956 Act, and in Regulations, by reference to a shade on the British Standard Ringelmann Chart (see page 45) as:

"Dark" smoke (defined in S.34 of the 1956 Act) means smoke which if compared . . . with the Ringelmann Chart would appear to be as dark as or darker than shade 2 on the chart.

"Black" smoke (defined in the Dark Smoke (Permitted Periods) Regulations 1958; and in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 means smoke which, if compared . . . with the Ringelmann Chart, would appear to be as dark as or darker than shade 4 on the chart.

B Use of Aids in Assessing Smoke Colour:

Although legislation defines dark and black smoke by reference to colour shades on the Ringelmann Chart, the use of the Chart is not compulsory. S.34(2) of the 1956 Act says that "For the avoidance of doubt, it is hereby declared that . . . the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type."

C Design Standards for New Plant

Section 3 of the Clean Air Act 1956 requires all new furnaces (other than domestic boilers with a rating less than 55,000 Btu/hr.) to be, so far as practicable, capable of operating continuously without emitting smoke when burning fuel of a type for which the furnace was designed.

There is no definition of "furnace", but a practical interpretation of this word wherever it appears in Clean Air legislation, is usually taken as "any enclosed or partly enclosed space in which liquid, solid or gaseous matter is burned, or in which heat is produced".

It is a requirement of this section that the proposed installation of all new furnaces (other than domestic boilers rated at less than 55,000 Btu/hr.) *must* be notified to the local authority, and if one wishes to do so, one may apply for local authority approval that the proposed unit is capable of substantially smokeless operation. The approval does not, however, allow indiscriminate smoke emission and the furnace must be operated to ensure that permissible emissions are not exceeded.

D Standards for Smoke Emission:

Section one of the Clean Air Act 1956 prohibits the emission of dark smoke from a chimney, but also allows the Secretary of State for the Environment to make regulations exempting prescribed lengths of emission from possible action under this section.

The "permitted emissions" are prescribed in the Dark Smoke (Permitted Periods) Regulation 1958: and the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958.

D(1) The Dark Smoke (Permitted Periods) Regulations 1958 (Statutory Instrument 1958 No. 498)

(*a*) **Aggregate emissions of dark smoke.**

Number of furnaces served by the chimney	*Permitted emission of dark smoke in any period of eight hours*	
	If not soot blowing during period	*If soot blowing during period*
One	10 mins.	14 mins.
Two	18 mins.	25 mins.
Three	24 mins.	34 mins.
Four or more	29 mins.	41 mins.

Where a single boiler or unit of industrial plant is fired by more than one furnace discharging into the same chimney, those furnaces shall be deemed to be one furnace.

(*b*) **Continuous emissions of dark smoke**

The continuous emission of dark smoke in excess of four minutes, caused otherwise than by soot blowing, is prohibited.

(*c*) **Aggregate emission of black smoke**

No emission of black smoke exceeding two minutes aggregate in any period of thirty minutes is allowed.

There are thus three standards of emission which are acceptable in relation to any one chimney. The penalty for an offence under section one of the Act is a fine not exceeding £100 for each day on which the offence occurs.

D(2) The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (Statutory Instrument 1958 No. 878)

By the provisions of section 20 of the 1956 Act, vessels in waters not navigable by sea-going ships and in certain waters within the seaward limits of the territorial waters of the United Kingdom, must comply with the dark smoke provisions of section one of the 1956 Act, subject to the permitted emissions contained in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958, as follows:—

Class of Case	*Permitted Period for Emission of Dark Smoke*
1. Emissions from a forced draught oil-fired boiler furnace, or an oil engine.	10 minutes in the aggregate in any period of 2 hours.
2. Emission from a natural draught oil-fired boiler furnace (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
3. Emissions from a coal-fired boiler furnace:—	
(*a*) when the vessel is not under way (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
(*b*) when the vessel is under way.	20 minutes in the aggregate in any period of one hour.
4. Emissions from a natural draught oil-fired boiler furnace or a coal-fired boiler furnace in the following cases:—	
(*a*) a vessel with funnels shortened for the purpose of navigating the Manchester Ship Canal;	20 minutes in the aggregate in any period of one hour.
(*b*) a tug not under way, but preparing to get under way or supplying power to other vessels or to shore installations;	
(*c*) a vessel not under way but using main power for the purpose of dredging, lifting, pumping or performing some other special operation for which the vessel is designed.	
5. Emissions from any other source.	5 minutes in the aggregate in any period of 1 hour.

A vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground shall be deemed to be under way. The Regulations include a proviso that:

(*a*) **continuous emissions of dark smoke caused otherwise than by the soot blowing of a water tube boiler shall not exceed**

(i) in the case of classes 1 and 2, 4 minutes;
(ii) in the case of natural draught oil-fired boiler furnaces in class 4, 10 minutes; and
(iii) in no case shall black smoke be emitted for more than 3 minutes in the aggregate in any period of 30 minutes.

D(3) Defences for excessive dark and black smoke emission

Section one of the 1956 Act contains three defences which may be available if an occupier of premises is proceeded against for dark/black smoke emission. These briefly are that the emission was:—

(*a*) solely due to lighting a furnace from cold and all practicable steps had been taken to minimise emissions.
(*b*) solely due to unavoidable mechanical failure of part of the plant and the contravention could not have been prevented after failure occurred.
(*c*) solely due to the unavoidable use of unsuitable fuel, suitable fuel not being available and the best available fuel being used; and all practicable steps were taken to minimise the emission.
(*d*) due to any combination of (*a*), (*b*) and (*c*).

N.B. That these are not absolute defences and are available only if every practical effort is made to avoid and/or minimise emissions.

E **Emissions of Dark Smoke from "Bonfires", etc.**

On 1st October 1969 Section one of the Clean Air Act 1968 became operative. This section prohibits (subject to prescribed exemptions) the emission of dark smoke from industrial or trade premises (as distinct from chimneys) and is concerned mainly with preventing excessive smoke emission caused by the indiscriminate burning of industrial or trade refuse in the open, but this section will also control dark smoke emissions from industrial processes not having a chimney.

In this connection, "industrial or trade premises" means premises normally used for industrial or trade purposes, or premises not normally so used, but which, at the time of the offence, were being used for industrial or trade burning.

The Secretary of State has made the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 which exempt the emission of dark smoke caused by the burning of the following materials, subject to the specified conditions:—

Exempted Matter

(1) *Matter*	(2) *Conditions*
1. Timber and any other waste matter (other than natural or synthetic rubber or flock or feathers) which results from the demolition of a building or clearance of a site in connection with any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961).	Conditions A, B and C.
2. Explosive (within the meaning of the Explosives Act 1875) which has become waste; and matter which has been contaminated by such explosive.	Conditions A and C.
3. Matter which is burnt in connection with (*a*) research into the cause or control of fire or (*b*) training in fire fighting.	Condition C.
4. Tar, pitch, asphalte and other matter which is burnt in connection with the preparation and laying of any surface, or which is burnt off any surface in connection with resurfacing, together with any fuel used for any such purpose.	Condition C.
5. Carcasses of animals or poultry which (*a*) have died, or are reasonably believed to have died, because of disease; (*b*) have been slaughtered because of disease; or (*c*) have been required to be slaughtered pursuant to the Diseases of Animals Act 1950.	Conditions A and C, unless the burning is carried out by or on behalf of an inspector (within the meaning of Section 84 of the Diseases of Animals Act 1950).
6. Containers which are contaminated by any pesticide or by any toxic substance used for veterinary or agricultural purposes; and in this paragraph "container" includes any sack, box, package or receptacle of any kind.	Conditions A, B and C.

The conditions referred to in column 2 are:—

CONDITION A That there is no other reasonably safe and practicable method of disposing of the matter.
CONDITION B That the burning is carried out in such a manner as to minimise the emission of dark smoke.
CONDITION C That the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on his behalf.

F **Smoke Control Areas:**

Sections 11 to 15 of the Clean Air Act 1956, Sections 8 to 10 of the 1968 Act and Section 95 of the Housing Act 1964 relate to Smoke Control Areas, the administrative procedures, and the enforcement of Smoke Control Orders.

Section 11 of the 1956 Act allows a Local Authority to make a Smoke Control Order which must be submitted to the Secretary of State of the Environment for confirmation. When operative it is an offence for an occupier of premises to allow smoke emission from a chimney, unless the smoke is caused by the use of an "authorised fuel"; or the "fireplace" which the chimney serves is exempt from the Order.

The Clean Air (Authorised Fuels) Regulations 1956, 1963, 1965, 1969, 1970 (No. 2), 1971, 1971 (No. 2), 1971 (No. 3) and 1971 (No. 4) allow the use of the following fuels in Smoke Control Areas, even though some may for short periods cause light smoke emission:—

Anthracite	
Low Volatile Steam Coal	
Phurnacite Ovoids	Manufactured solid smokeless fuels
Coalite, Rexco and Rexco Ovoids	
Gloco and Gas Coke	
Homefire and Roomheat	
Multiheat	
Sunbrite and ‘hard’ coke	
Cosiglow	
Maxiglow	
Fireglo briquettes	
Ancit briquettes	
Extracite ovoids	
Syntracite ovoids	
XL briquettes	
Anthracine ovoids	
Anthrite ovoids	
Gas and Electricity	

Other solid fuels are at various times submitted to the Department of the Environment for testing to determine whether or not they might become “Authorised Fuels” for use in Smoke Control Areas.

The Smoke Control Areas (Exempted Fireplaces) Orders 1970, 1970 (No. 2) 1971, 1972 and 1972 (No. 2) conditionally exempt the emission of smoke from chimneys serving the following fireplaces:—

Class of Fireplace	*Conditions*
A. 1970 Order	
1. Any fireplace specially designed or adapted for combustion of liquid fuel.	
2. Any fireplace (other than a fireplace fired by pulverised fuel) constructed on or after 31st December 1956 and installed before 1st May 1970 and equipped with mechanical stokers, or adapted between those dates for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
3. Any fireplace designed to burn coal (other than a fireplace fired by pulverised coal) with a heating capacity exceeding 150,000 Btu/hr. constructed and installed on or after 31st December 1956 and equipped with mechanical stokers or adapted on or after that date for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
4. The fireplace known as the Solid Fuel Ductair Unit, manufactured by Radiation Limited.	
5. The fireplace known as the Fulgora Slow Combustion Stove, manufactured by Fulgora Stoves Limited.	No fuel shall be used other than wood waste in clean condition.
6. The fireplace known as the Housewarmer manufactured for the National Coal Board by Ideal Standard Limited	No fuel shall be used other than selected washed coal marketed under the name “Housewarm” by agreement with the National Coal Board.
7. The fireplace known as the Wood Chip Fired Air Heater, manufactured by Air Plants Ltd.	No fuel shall be used other than clean wood waste of a size within the limits referred to in the manufacturer’s instructions.
8. The fireplace known as the Hounsell Sawdust Burning Stove, manufactured by John Hounsell (Engineers) Ltd.	No fuel shall be used other than wood waste in clean condition.
B. 1970 (No. 2) Order (S.I. 1970 No. 1667). The fireplace known as the Triancomatic T.80	No fuel shall be used other than selected washed coal marketed under the name “Housewarm” by agreement with the National Coal Board.
C. 1971 Order (S.I. 1971 No. 1265) The fireplace known as the Rayburn CB34.	
D. 1972 Order (S.I. 1972 No. 438). The fireplace known as the Parkray Coalmaster.	
E. 1972 (No. 2) Order (S.I. 1972 No. 955) The fireplace known as the Trianco TGB 17.	
F. 1973 Order (S.I. 1973 No. 2166) The fireplace known as the Rayburn Prince 101. The fireplace known as the Rayburn Prince 301.	

In addition to the conditions above two standard conditions require all appliances to be installed, maintained and operated

(i) so as to minimise the emission of smoke;
(ii) in accordance with the manufacturer's instructions.

The local authority may also include in the Smoke Control Order other exemptions, which they may feel are necessary, subject to reasonable conditions. One of these is to allow the lighting of domestic fires with sticks and paper if there is no gas in the dwelling.

Thus, coal, oil and waste wood may not normally be burnt either by a householder or an industrialist unless on an exempted appliance, the design of which has satisfied the Secretary of State that it is capable of being operated substantially smokelessly and is exempted by Statutory Instrument.

The 1968 Act extended the Smoke Control provisions of the 1956 Act. The Minister is now empowered to require a local authority to make Smoke Control Orders. It is also an offence to acquire or to sell by retail for delivery in a Smoke Control Area any fuel other than an authorised fuel, unless in each case the premises or fireplace are exempt.

The financial provisions of the 1956 Act require the local authority to pay to owners or occupiers of dwelling houses a grant of 7/10ths of the reasonable cost of fireplace adaptations, and they may repay all or any part of the remaining 3/10ths. The local authority recovers 4/7ths of the grant from the Exchequer. A grant is not available in respect of a "new dwelling" begun on or after 16th August 1964.

The Housing Act 1964 allows a local authority to "designate" as unsuitable any appliances for which suitable fuels are not fully available, and in those circumstances a grant is not available for installation of those appliances.

Section 10 of the 1968 Act prevents a local authority from postponing the operation of a Smoke Control Order by more than 12 months.

Grant Arrangements

The principles which local authorities must follow in assessing eligibility of works of adaptation for grant are contained in the Memorandum on Smoke Control Areas revised by the Department of the Environment Circular 51/65. In Circular 32/71 the Department set cost limits for local authority guidance in assessing "reasonable costs":—

Smoke Control Area Grants: Cost Limits for Various Appliances (Circular 135/73) (under revision by DOE 1975)

	£
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar)	11
Improved open fire (including integral gas ignition and, where necessary deepening plate and bar) with boiler	24*
Underfloor draught fire and fan assisted open fire	25
Underfloor draught fire and fan assisted open fire with boiler	33*
Solid fuel room heater	45
Solid fuel room heater with boiler	56*
Gas room heater	32
Electric thermal storage heater	39
Direct acting electric space heater	22
Oil room heater	32
Solid fuel cooker with boiler	132
Gas or electric cooker	60
Independent solid fuel boiler, **including installation**	55
Gas water heater (e.g. gas circulator and back boiler unit), **including installation**	44
Electric immersion water heater, **including installation**	27
Wash boiler, gas and electric	22
Gas poker, including flex and tap	5
Bottled gas igniter, if gas container is hired	4
Bottled gas igniter, including purchase of gas container	10
Electric kindler	10

*£3 may be added where
- (i) it would be impossible or inadvisable to connect the existing boiler to the new space-heating appliance, and
- (ii) either
  - (*a*) the existing boiler is itself bower-barffed or made of stainless steel, copper, aluminium, bronze or other superior material, or
  - (*b*) one of the above types is necessary to comply with local water bye-laws.

It is for the local authority to decide, within the appropriate level, what costs are reasonable in each case. In general the Department of the Environment will not accept as eligible for grant any expenditure which exceeds the stated limit.

G Statutory Procedure in the Event of an Offence for Excessive Smoke Emission* (modified by CPA 1974)

Section 30 of the 1956 Act requires the local authority authorised officer (usually the Public Health Inspector) to notify "as soon as may be" the occupier of the premises of the offence and to confirm his notification in writing within 48 hours of becoming aware of the offence.

This requirement applies to a contravention of Section one and eleven of the 1956 Act, i.e. Dark/Black smoke emission, and smoke emission in a smoke control area, and to Section one of the 1968 Act, i.e. dark smoke emission from industrial or trade burning. In any subsequent proceedings it is a defence to prove that the notification was not made "as soon as may be" or that the notification was not confirmed within two days following the date of offence.

H Statutory Smoke Nuisance:

Part III of the Public Health Act 1936 defines certain statutory nuisances, and prescribes the legal procedure for enforcing their abatement.

Section 16 of the Clean Air Act 1956 extends the provisions of Part III of the Public Health Act 1936, to include smoke nuisance, but a smoke nuisance cannot include:—

(i) smoke emitted from a chimney of a private dwelling, or
(ii) dark smoke from a chimney of a building or boiler or other plant (controlled by Section 1 of the 1956 Act), or
(iii) dark smoke caused by industrial or trade burning (controlled by Section 1 of the 1968 Act).

Where a smoke nuisance exists, the local authority may pursue the lengthy and cumbersome nuisance procedure, but if they are satisfied that the nuisance has occurred, has temporarily ceased, but is likely to recur, they may, without serving an Abatement Notice, cause a complaint to be made to the Magistrate's Court for the making of a Nuisance Order, following which the provisions of Part III of the Public Health Act 1936 for enforcement of the Order will apply.

Summary of the provisions relating to smoke emission

1. New plant must be capable of substantially smokeless operation.
2. The proposed installation of new furnaces must be notified to the local authority.
3. There are permitted periods for dark and black smoke emission from chimneys, and these standards apply throughout England and Wales.
4. The Permitted Periods Regulations apply whether or not premises are subject to a Smoke Control Order, but additionally, if in a Smoke Control Area, the occupier must ensure that smoke emission is prevented, or, where plant or premises are conditionally exempted, he must ensure that smoke emission is minimised.
5. A grant of 7/10ths of reasonable expenditure is available for the adaptation or replacement of domestic coal burning and similar open fires in a Smoke Control Area.
6. Dark smoke emission from bonfires, etc., on industrial or trade premises is, subject to exemptions, prohibited.
7. The authorised officer must notify the occupier of premises as soon as may be of the existence of an offence, and must confirm his notification in writing within 48 hours.
8. Smoke, other than smoke emitted from a dwelling, dark smoke from a chimney or dark smoke from industrial or trade burning, may if it causes a nuisance be regarded as a Statutory Nuisance under the Public Health Acts.

2. THE CONTROL OF CHIMNEY HEIGHTS

At whatever height smoke and flue gases are discharged, gravity will eventually bring the larger particles of grit, dust and soot to the ground. Additionally, because of the natural turbulence of the atmosphere, a proportion of the gases and of the freely suspended fine particles will reach the ground although not affected by gravity. The higher the point of discharge and the greater the total heat content of the discharge gases, the more widespread and diluted will be the fine particles and gases by the time they reach ground level.

The Legal Control of Chimney Heights

The legal control of chimney heights enables the local authority to take into account a number of relevant factors in determining the height of a chimney to avoid down draught or down wash created by the chimney itself, by buildings or topographical features, and to avoid the ground level concentration of the products of combustion from becoming prejudicial to health or a nuisance, or in the case of smaller units to prevent the flue gases from entering nearby buildings in too high a concentration. All chimneys must comply with the structural requirements of the Building Regulations 1972, but the control of the height or position of the terminal is now exercised under the provisions of the Clean Air Act 1968 or the Building Regulations 1972, according to the fuel consumption of the plant served by the chimney. Further control is available in the Public Health Act 1961 when a new building is proposed which will over-reach the chimney of an adjacent building and affect the dispersal of the products of combustion.

A The Clean Air Act 1968—Section 6

This section of the 1968 Act amends and extends the provisions of Section 10 of the Clean Air Act 1956, which it has largely replaced (except to control the height of chimneys serving non-combustion processes).

Whereas by Section 10 of the 1956 Act a local authority could control a chimney height only if building plans indicating a proposal to erect a chimney were submitted for approval, it must now, under the new provisions, consider a chimney height when:—

(i) a new chimney is erected to serve a new or existing furnace,
(ii) a furnace served by an existing chimney is enlarged, i.e. when its combustion space is increased, e.g. by the addition of a new furnace to an existing range of furnaces,
(iii) a furnace served by an existing chimney is removed and replaced by one having a larger combustion space,

but only if the furnace:—

(*a*) burns or is to burn pulverised fuel; or
(*b*) burns or is to burn at a rate of 100 lbs. or more an hour any other solid matter; or
(*c*) burns or is to burn at a rate equivalent to 1¼ million Btu or more per hour any liquid or gaseous matter.

An application for chimney height approval should preferably be on the form prescribed in the Clean Air (Heights of Chimneys) (Prescribed Form) Regulations 1969 (Statutory Instrument 1969 No. 412) but this does not preclude the local authority from considering an application even though not on the prescribed form, if the information provided by the applicant is sufficient.

The local authority must consider an application and give a written decision within 28 days of receiving the application, unless it is agreed in writing between the local authority and the applicant that a longer period may be allowed; the local authority, however, must not approve the proposed chimney height unless they are satisfied that it will be sufficient to prevent, so far as is practicable, the smoke, grit, dust, gases or fumes emitted from the chimney from becoming prejudicial to health or a nuisance, having regard to:—

(i) the purpose of the chimney,
(ii) the position and descriptions of buildings near to it,
(iii) the levels of the neighbouring ground,
(iv) any other matters requiring consideration in the circumstances.

Any approval of the height of a chimney may be granted unconditionally or subject to conditions as to the rate and/or quality of emissions from the chimney.

> "rate of emission" is defined as the quantities of any specified substance which may be emitted in a period specified in the conditions attached to the approval, e.g. lbs./hr. of sulphur dioxide.

Many other miscellaneous emissions may, of necessity, be considered for inclusion in conditions as to the rate of emission, but there will be cases where a limitation on "rate" alone will not sufficiently ensure against excessive pollution by materials other than normal combustion products, and in those cases it might be appropriate to impose conditions as to the "quality" (i.e. concentration) of the emission.

A limitation on the quality of emission would be appropriate if the products of combustion contain gases or acid mists resulting from abnormal reactions or breakdown of materials derived from chlorinated or sulphur bearing compounds, etc., or if products of combustion are mixed with waste gases from non-combustion processes.

There will also be occasions, particularly in relation to metallurgical processes, where the optical density of emissions may be regulated by reference to percentage obscuration or perhaps by reference to the Bacharach scale.

If a local authority fails to give a written decision within 28 days, the approval applied for is deemed to be granted without qualification.

If the local authority decide not to approve the height of a chimney or to attach conditions to their approval, they must give the applicant a written notification of their decision, stating their reasons, and they must additionally specify the lowest height, if any, which they are prepared to approve unconditionally and/or the lowest height they are prepared to approve with any specified conditions. The applicant may, within 28 days, appeal against the decision to the Secretary of State for the Environment, or the Secretary of State for Wales or for Scotland as appropriate.

In the event of an appeal being lodged, the Secretary of State may confirm the decision against which the appeal is made, or may amend the height or conditions as he thinks appropriate. He must also give a written notification of his decision stating his reasons and, where he does not approve a chimney height, specifying what height, with and/or without conditions, he would approve.

It is not necessary to apply for chimney height approval for any exempted boiler or plant, and the Secretary of State has made the Clean Air (Heights of Chimneys) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 411).

These Regulations provide in substance that chimney height approval is not required where a boiler or plant is used:—

(i) as temporary replacement for a boiler or plant which is under inspection or being maintained, repaired, rebuilt, or replaced by another permanent boiler or plant;
(ii) as a temporary source of heat or power for building or engineering construction work;
(iii) as a temporary source of heat or power for investigation or research;
(iv) as an auxiliary plant used to bring other plant to an operating temperature;
(v) as a mobile or transportable source of heat or power for agricultural operations.

Although a boiler or plant, when used wholly for one of the prescribed purposes, is exempt from the provisions requiring the height of the chimney to be approved, it is nevertheless subject to the other relevant provisions of the Clean Air Acts, and to the nuisance provisions of the Public Health Act 1936.

The Practical Determination of the Height of Chimneys Controlled Under the Clean Air Act 1968

Products of combustion emitted from chimneys serving furnaces burning conventional solid, liquid or gaseous fuels may contain:—

(*a*) *Solids*
Smoke, dust, ash, grit, fume.
(*b*) *Gases*
Carbon monoxide, carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen, hydrocarbons, oxygen and nitrogen; and a number of other minor constituents, including a host of trace elements.

By good combustion and the installation of efficient arrestors, the emission of solids, and to a lesser extent some of the gases, can be minimised, but removal of, for instance, sulphur dioxide is impracticable and the gases must therefore be discharged through a chimney of adequate height.

The basic thesis in the use of tall chimneys for waste gas dispersal is that there are no such things as dangerous gases or fumes, only dangerous concentrations.

The function of the chimney is to reduce the resulting ground level concentration of each constituent of the emission so that it is below the threshold which gives rise to a health hazard or a nuisance.

Under ideal conditions, and so far as gases are concerned, the ground level concentrations from a chimney discharge vary directly with the mass rate of emission and inversely with the wind speed and the square of the effective chimney height. Maximum ground level concentrations occur at about 10–15 times effective chimney heights distance.

Until the first edition of the Memorandum on Chimney Heights issued by the Ministry of Housing and Local Government in 1963, local authorities had a number of formulae which they could use for the calculation of a chimney height, particularly those recommended by the Beaver Committee in Appendix VI of its Final Report.

Revised in October 1967, the Memorandum on Chimney Heights still follows the basic principle in the amended edition that the pollution downwind from a chimney should not exceed a predetermined limit and that pollutants from the chimney must be considered in relation to pollution which exists from other sources.

Using either an average sulphur content for coal and oil of 1·6% and 3% respectively, or preferably using the known sulphur content, it is easy to calculate the mass emission of SO_2 (not forgetting that in the case of coal, 10% of the sulphur remains in the ash). In practice, because of the tremendous variation in sulphur content of coal it is usual to take the average of 1·6% for determining chimney heights, but to use the specification maximum for a particular class of oil when that fuel is to be used. It is also usual to base the fuel consumption on the maximum continuous rating of the boiler or other plant. Thus the chimney height is based on the maximum possible SO_2 emission from the plant and gives the industrialist some flexibility in the amount of fuel he might then burn without contravening the Act.

In the Memorandum, after the introduction of a description of the method, are printed a number of charts which allow firstly an uncorrected chimney height to be obtained based on SO_2 emission and the type of locality; and secondly a final height to be obtained by relating the uncorrected height to the height and/or length of the building in which the furnace is installed or the height of adjacent buildings.

An accurate assessment of the type of locality is important in determining the uncorrected chimney height, and the Memorandum gives the following guidance:—

(*a*) An undeveloped area where development is unlikely, where background pollution is low, and where there is no development within half a mile of the new chimney.
(*b*) A partially developed area with scattered houses, low background pollution, and no other comparable industrial emissions within a quarter of a mile of the new chimney.
(*c*) A built-up residential area with only moderate background pollution and without other comparable industrial emissions.
(*d*) An urban area of mixed industrial and residential development, with considerable background pollution and with other comparable industrial emissions within a quarter of a mile of the new chimney.
(*e*) A large city, or an urban area of mixed heavy industrial and dense residential development, with severe background pollution.

Category *c* represents average conditions, whilst categories *a*, *b*, *d* and *e* represent adjustments up or down, according to probable existing background pollution. Thus a chimney will be lower in Area *a* than in Area *c*, and highest in Area *e*.

It is emphasised that the Memorandum provides a relatively simple method of calculating the approximate chimney height commonly desirable in normal circumstances. There will sometimes, however, be occasions involving complex developments, or topographical complications, which are impossible to assess precisely by either experience or mathematics and it will then be necessary to have wind tunnel tests carried out on scale models.

Heights of Chimneys Serving Furnaces Not Burning Sulphur Bearing Fuels

The Memorandum can be utilised for determining stack heights only if the "fuel" contains sulphur in significant proportions, and there are no constituents of the chimney gases that are of more importance in relation to public health or nuisance than sulphur dioxide. Where there is no SO_2 emission, or where other constituents are of more importance, the height of the chimney cannot be assessed by use of the Memorandum on Chimney Heights. During 1970 the Warren Spring Working Group on Chimney Heights was reconstituted to produce a report recommending chimney heights for furnaces to burn natural gas, towns gas, liquid petroleum gas and low sulphur fuel oils. The working group is expected to produce its report during 1973.

B Clean Air Act 1956—Section 10

Although Section 10 of the 1956 Act no longer applies to a chimney serving a furnace, it will still apply to a chimney serving a non-combustion process, providing Building Regulation plans are required to be submitted for local authority approval. If the chimney is insufficient to prevent the emissions from becoming prejudicial to health or a nuisance, the local authority must reject the plans, and an aggrieved applicant may appeal to the Secretary of State for the Environment.

C. The Building Regulations 1972

The earlier notes show that the Clean Air Acts control chimney heights only if the fuel consumption is 100 lbs. or 1·25 million Btu or more per hour.

The Building Regulations 1972 apply to *all* chimneys irrespective of the capacity of the fireplace or furnace, no matter in what type of building the unit is installed.

Regulation L2(4)(*a*) requires that the flue outlet of a high rating appliance shall be so situated as to prevent the discharge therefrom into the external air from entering any opening into a building in such a concentration as to be prejudicial to health or a nuisance.

A "high rating appliance" is defined as
(*a*) a solid fuel burning appliance or oil burning appliance with an output rating exceeding 45 kw.
(*b*) a gas appliance having an input rating exceeding 45 kw.
(*c*) an incinerator having a refuse combustion chamber exceeding 0·03m^3 in capacity.

In the case of Class I or Class II appliances the flue terminals must be correctly placed in accordance with Regulations 13 and 21 respectively.

A "Class I appliance" is defined as
(*a*) a solid fuel appliance or oil burning appliance having an output rating not exceeding 45 kw.
(*b*) an incinerator having a refuse combustion chamber capacity between 0·03m^3 to 0·08m^3.

A "Class II appliance" is defined as
(*a*) a gas appliance having an input rating not exceeding 45 kw.
(*b*) an incinerator having a refuse combustion chamber not exceeding 0·03m^3 in capacity.

D Public Health Act 1961

Section 28 of this Act applies when a new building is erected which will overreach the chimney of an adjoining building.

Providing that the chimney of the lower building is in the party wall between it and the taller building, or is 6 feet or less from the taller building, the local authority may by notice require the person who erects the taller building to raise the height of the chimneys of the adjoining building if it is reasonably practicable to do so, so that the chimneys are the same height as the taller building or its chimneys, whichever is the higher.

The notice will also require the owner or occupier of the adjoining building to allow the work to be done, but he may elect to do the work himself and charge the reasonable cost of so doing to the person on whom the notice was served.

In the event of non-compliance with the notice, the local authority may do the work in default.

Chimney Design

It is essential to emphasise that whilst the physical and effective heights of any chimney are of importance in ensuring the eventual dispersion of the waste gases etc., other features of the chimney (e.g. its shape, quality of thermal insulation, and cross sectional area at the outlet) must be carefully designed if stack inversion, acid condensate, smut emission, and downwash are to be avoided.

Summary of the Provisions Relating to Chimney Heights

The occupier of premises must seek approval of a chimney height when:—

1. (i) a new chimney is to be erected,
   (ii) an existing furnace installation is to be enlarged,
   (iii) a furnace is to be replaced by one of larger combustion capacity,
   but only if the new or enlarged plant is to burn pulverised fuel; other solid matter at 100 lbs. or more per hour; or liquid or gaseous matter at 1·25 million Btu or more per hour.
2. The local authority must give a written decision within 28 days, and may prescribe conditions.
3. The applicant can appeal to the Secretary of State for the Environment within 28 days of receiving the local authority decision, if aggrieved by the decision or conditions.
4. Chimney height approval is not required for certain exempted plant—mainly of temporary or experimental nature.
5. All chimneys must comply with the relevant provisions of the Building Regulations 1972 as to the position of the terminal.
6. In general the Ministry Memorandum on Chimney Heights is used, unless there are parameters more important than SO_2 emission which must be considered.
7. In some circumstances, the developer of a tall building may be required to raise the height of the chimneys of an adjoining building.

3. THE CONTROL OF GRIT, DUST AND FUME EMISSIONS

Although "grit" is defined in the Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 as "particles exceeding 76 microns in diameter", and "fume" is defined in the 1968 Act as "solid particulate matter smaller than dust", there is no definition of "dust".

It is, however, generally accepted that "dust is particulate matter smaller than 76 microns with a lower limit of one micron" and "fume" is sub-micronic in size.

Under the provisions of the 1956 Act the underlying principle in relation to stack solids was that any practicable means should be used for minimising grit and dust emissions. The various definitions recognised that technical problems would prevent the

complete elimination of emissions and that the measures required would vary according to circumstances. The requirement for grit arrestors to be installed in connection with new plant related only to those burning pulverised fuel, or other solid matter at the rate of one ton or more per hour.

The provisions of the 1968 Act take these first principles a stage further and also allow the various provisions to be related to fume emission as and when the Secretary of State feels the time to be appropriate.

The new provisions considerably strengthen and extend the local authority powers in relation to this problem, and since they are of fundamental importance they are set down under a series of sub-headings.

A Power of the Secretary of State to Prescribe Limits of Emission

Section two of the 1968 Act gives the Secretary of State power to prescribe limits on the rates of emission of grit and dust from the chimneys of furnaces, and to prescribe different limits for different cases and according to different circumstances.

(i) Working Party on Grit and Dust Emissions

During 1964 the then Minister of Housing and Local Government was considering the possibility of making Regulations to enable local authorities to require industrialists to measure grit and dust emissions. He decided that before doing so it would be advisable for local authority staff to receive guidance as to the available methods of measuring grit and dust, and the levels of emission, from various types of plant, which would be acceptable. Accordingly a Working Party on Grit and Dust Emissions was convened with the following terms of reference:—

> "To consider ways and means of measuring grit and dust emissions and to advise on the levels of emission admissible in relation to furnaces burning fuel equivalent to 100 lbs. to 50,000 lbs. of coal per hour."

The Report, published in 1967 proposed limits on the acceptable levels of emission from coal fired and oil fired boilers, and from furnaces where the stock being heated does not contribute to the emissions.

The working party considered that there was insufficient reliable data of emissions from furnaces where the stock contributed to emissions, or from incinerators, and recommended that there should be initiated a systematic study to obtain emission data from a representative sample of these classes of furnaces and, at the same time, to obtain some reliable information on the current technology of emission prevention. This study has recently been undertaken by N.I.F.E.S.

Those recommendations included in the Report were stated in lbs./hour of grit and dust emitted during a period of normal operation, including peak loads. In the case of coal fired plant the acceptable emissions ranged from 1% of the fuel, fired at a low rate of burning (100 lbs./hour) to 0·5% of the fuel fired at the top rate of burning (50,000 lbs./hour); and in the case of oil fired plant the acceptable emissions reduced from 0·4% of the fuel fired at a low rate of burning to 0·2% of the fuel fired at the top rate of burning. In the case of coal fired plant the working party recommended that the percentage grit in the sample from plant burning up to one ton per hour should not exceed 33%, and from plant burning over one ton per hour should not exceed 20%.

The Report of the Working Party was later endorsed by the then Ministry of Housing and Local Government in its publication "Grit and Dust—The Measurement of Emissions from Boiler and Furnace Chimneys—Standard Levels of Emission."

(ii) The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (Statutory Instrument 1971 No. 162)

The Regulations were made on the 1st February 1971, and came into operation on the 1st November 1971. They express in parliamentary and legal terminology the recommendations of the Working Party on Grit and Dust Emissions, but for a period until 1st January 1978 the Regulations will apply only to plant for which an agreement in respect of its purchase or installation was entered into after the date of operation i.e. there is a seven year exemption for existing installations.

The Regulations apply to:—

(*a*) boilers;
(*b*) indirect heating appliances (being heating appliances in which the combustion gases are not in contact with the material being heated);
(*c*) furnaces in which the combustion gases are in contact with the material being heated but that material does not in itself contribute to the grit and dust in the combustion gases.

The Regulations do not apply to incinerators burning refuse or waste matter (solid or liquid) whether or not the resulting heat is used for any purpose.

Schedules 1 and 2 of the Regulations tabulate the quantities of grit and dust which may be emitted, and where the rating of the boiler or furnace is intermediate between the tabulated values, the maximum permitted emission is obtained by interpolation:—

Schedule 1—Furnaces Rated by Heat Output

This schedule applies to boilers and also indirect heating appliances in which the material being heated is a gas or a liquid (e.g. an air heater) but where an indirect heating appliance falls also within the provisions of schedule 2, it shall be treated as schedule 1 furnace.

The amount of grit and dust which may be emitted is as follows:—

Max. Continuous Rating in lbs. of steam/hr. (from and at 100°C (212°F) or in thousands of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning solid matter	*Furnaces burning liquid matter*
,825	1·10	0·25
1,000	1·33	0·28
2,000	2·67	0·56
3,000	4·00	0·84
4,000	5·33	1·12
5,000	6·67	1·4
7,500	8·50	2·1
10,000	10·00	2·8
15,000	13·33	4·2
20,000	16·67	5·6
25,000	20·0	7·0
30,000	23·4	8·4
40,000	30	11·2
50,000	37	12·5
100,000	66	18
150,000	94	24
200,000	122	29
250,000	149	36
300,000	172	41
350,000	195	45
400,000	217	50
450,000	239	54·5
475,000	250	57

Schedule 2—Furnaces Rated by Heat Input

This schedule applies to indirect heating appliances and to furnaces in which the combustion gases are in contact with the material being heated, but that material does not in itself contribute to the grit and dust in the combustion gases.

The amount of grit and dust which may be emitted is as follows:—

Heat input in millions of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning Solid Matter	*Furnaces burning Liquid Matter*
1·25	1·1	0·28
2·5	2·1	0·55
5·0	4·3	1·1
7·5	6·8	1·7
10	7·6	2·2
15	9·7	3·3
20	11·9	4·4
25	14·1	5·5
30	16·3	6·6
35	18·4	7·7
40	20·6	8·8
45	22·8	9·8
50	25	10·9
100	45	16
200	90	26
300	132	35
400	175	44
500	218	54
575	250	57

The Regulations limit the grit in the sample of grit and dust to the following proportions:—

	Grit not to exceed 33%	*Grit not to exceed* 20%
Schedule One Furnaces	Where maximum continuous rating does not exceed 16,800 lbs./hr. of steam or 16,800,000 Btu/hr.	In any other case.
Schedule Two Furnaces	Where designed heat input of the furnace does not exceed 25,000,000 Btu/hr.	In any other case.

Grit is defined as those particles exceeding 76 microns in diameter (i.e. will remain on a BS.200 mesh sieve).

Multiflue chimneys are defined and for the purpose of the regulations each flue is to be taken as a separate chimney for the urpose of calculating acceptable emissions.

Where a chimney serves a furnace to which the regulations apply and also a furnace to which the regulations do not apply, he emissions from the latter shall be disregarded.

The prescribed limits apply to any period of standard operation of the furnace, including periods during which it is at or close to he loading to which it is subject for the greater part of its working time, or at any higher loading to which it is regularly subject or a limited time (whether or not this exceeds the furnace M.C.R. or designed heat input).

V.B. (1) Until the Regulations are made to apply to existing furnaces, or additional Regulations are made for furnaces where the material being heated contributes to the grit and dust emission, the occupier of the premises must use "any practicable means" for minimising the grit and dust emission.

(2) If the grit and dust emission from a chimney serving a furnace to which the Regulations apply, exceeds the permitted limit, there is a defence that the "best practicable means" had been used to prevent the emission.

The definition of "practicable" in the 1956 Act (it applies also to the 1968 Act) is of importance:—

> "Practicable" means reasonably practicable having regard, amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge, and "*practicable means*" *includes the provision and maintenance of plant and the proper use thereof.*

During 1972, the Secretary of State for the Environment appointed a new Working Party on Grit and Dust Emission with the ollowing terms of reference:—

> "To advise on the levels of emission admissible under Section 2 of the Clean Air Act 1968 in relation to incinerators, and to furnaces where the material being heated contributes to the emission."

The Report of the Second Working Party on Grit and Dust Emission was published during 1974 and recommends maximum evels of emission of grit and dust from three broad classes of furnace.

(a) Incinerators
(b) Cupolas
(c) Miscellaneous furnaces

In presenting the Report, the Working Party stresses the difficulty of differentiating for emission control purposes between grit and dust on the one hand and sub micron fume on the other. They recommend that yet another Working Party should be established in the near future to further examine the difficult problem of fume emission measurement and control.

The Report again defines grit as that material larger in size than 75 microns in diameter; defines dust (for the first time) as material smaller than grit, and fume as particles less in size than one micron.

Notwithstanding the problems of measurement, particle size determination and control of emission, the Report makes firm ecommendations for future legal limits of emission and should be consulted for detailed information. If, in due course, regulations are promulgated giving legal effect to the recommendations, they will be summarised in a future Year Book.

3 Arrestment Plant for New Furnaces

Section 6 of the Clean Air Act 1956 required that certain larger new furnaces, the installation of which was commenced (or was subject to an agreement signed) between July 1956 and October 1969, should be equipped with approved grit and dust arrestment plant and that the arrestors must be properly maintained and used. These provisions still apply to furnaces which are used:—

(i) to burn pulverised fuel; or
(ii) to burn, at a rate of one ton an hour or more solid fuel in any other form or solid waste,

providing that the plant was installed or an agreement was signed between the above-mentioned dates.

Section 3 of the 1968 Act states that if new plant is to be installed after the 1st October 1969 (or is subject to an agreement signed after that date) and it is to be used

(*a*) to burn pulverised fuel; or
(*b*) to burn, at a rate of 100 pounds or more an hour, any other solid matter; or
(*c*) to burn, at a rate equivalent to 1¼ million or more British thermal units an hour, any liquid or gaseous matter,

it must, unless exemption has been provided, be equipped with grit and dust arrestment plant. In the event of a local authority refusing approval there is a right of appeal to the Secretary of State within 28 days of receiving the local authority's written decision.

Two types of exemption are possible by virtue of Section 4 of the 1968 Act:—

(i) The Secretary of State has power to provide in Regulations that furnaces of any particular class, whilst used for a prescribed purpose, should be exempted. He has now made the Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 1262) as follows:—

Class of Furnace	*Purpose*
1. Mobile or transportable furnaces.	(*a*) Providing a temporary source of heat or power during any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961); (*b*) providing a temporary source of heat or power for investigation or research; (*c*) providing heat or power for the purpose of agriculture (within the meaning of section 109(3) of the Agriculture Act 1947).
2. Furnaces, other than furnaces designed to burn solid matter at a rate of one ton an hour or more, which fall within any of the following descriptions and in which the matter being heated does not contribute to the emission of grit and dust:— (*a*) Furnaces burning liquid matter, gas, or liquid matter and gas; (*b*) hand-fired sectional furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*c*) magazine type gravity-fed furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*d*) furnaces fitted with an underfeed stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of the plan area of the combustion chamber; (*e*) furnaces fitted with a chain grate stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*f*) furnaces fitted with a coking stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of area covered by the fire bars excluding the solid coking plate.	Any purpose except the incineration of refuse

(ii) The local authority may, on application, exempt a specific furnace installation providing that they are satisfied tha the emissions will not be prejudicial to health or a nuisance. The local authority must give a written decision within eight weeks, and an aggrieved applicant may appeal within a further 28 days, to the Secretary of State.

An offence occurs if a furnace is exempt and is then used for a purpose other than one prescribed in the exemption.

When considering an application for approval of a proposed arrestor plant (or an application for exemption from the need to install an arrestor plant) the local authority will have regard to the probable grit and dust burden in the flue gases, and to the known efficiency of the proposed arrestor plant in order that they might compare the probable emission with any standard which might at the time be in force or which is under consideration. Industrialists and consultants would, in turn, be wise to remembe that the Working Party on Grit and Dust Emissions proposed that their recommended standard levels of emission should be reviewed after three years in operation and that arrestor plant, unless very well maintained at all times, rarely operates at design efficiency after a few years in use.

C The Measurement of Grit and Dust Emissions

The legal provisions concerning the measurement of grit and dust emissions are to be found in Section 7 of the 1956 Act as amended by Section 5 of the 1968 Act. Regulations have been made which prescribe the procedure to be followed by a local authority which wishes grit and dust measurement to be made and by the industrialist on whom a notice has been served.

If a furnace (or range of furnaces served by one chimney) is used to burn:—

(i) pulverised fuel, or
(ii) any other solid matter at a rate of 100 lbs. or more per hour, or
(iii) any liquid or gaseous matter, at a rate equivalent to 1¼ million or more Btu/hr.

the local authority may serve a notice on the owner of the plant or occupier of the building, requiring grit and dust emissions to be measured.

If the plant burns:—

(i) less than one ton/hour of solid matter other than pulverised fuel, or
(ii) less than 28 million Btu/hour of liquid or gaseous matter.

the industrialist may serve a "counter notice" on the local authority, requiring the authority to carry out the measurements at its own expense, and the local authority is obliged to do so "from time to time" unless the counter notice is, in writing, withdrawn.

The Clean Air (Measurement of Grit and Dust) Regulations 1971 (Statutory Instrument 1971 No. 161), prescribe the administrative process to invoke the above provisions (a similar set of Regulations apply to Scotland):

(*a*) A local authority must give at least six weeks' notice in writing to an industrialist requiring:—

  (i) adaptations to be made to the chimney or flues, and
  (ii) the provision of the necessary equipment,

to enable measurements to be made in accordance with BS.3405:1961 "Simplified Methods for Measurement of Grit and Dust Emission from Chimneys". The British Standard describes five different types of equipment which can be used, and it is necessary to ensure that the type and position of sampling points is correct in relation to the type of equipment which will be used. The British Standard is currently under review.

(*b*) When the sampling points have been installed and the equipment provided (or it is known that the firm are engaging a consultant who possesses the equipment), the local authority must give at least 28 days' notice in writing, requiring the tests to be carried out in accordance with the methods details in pp.13–26 of the B.C.U.R.A. publication "Measurements of Solids in Flue Gases".

(*c*) Before making the measurement, the industrialist must give the local authority at least 48 hours' notice in writing, of the date and time of the commencement of the tests.

(*d*) The 1968 Act requires the industrialist to permit the local authority to be represented during the tests.

(*e*) The result of the test must be sent to the local authority within 14 days from the making of the measurements, and the reports shall include:—

  (i) the date(s) of the test(s);
  (ii) the number of furnaces discharging into the chimney on that date;
  (iii) the results of the measurements expressed in lbs./hour of grit and dust emitted, and in the case of solid fuel fired plant, the percentage of grit in the solids.

A notice may require the making of measurements from time to time or at stated intervals, but not at intervals of less than 3 months unless in the opinion of the local authority, the true level of emission cannot be determined without further measurement being made.

If an industrialist serves a "counter-notice" on the local authority, he need comply only with the (*a*)(i) above, i.e. make adaptations to the chimney to enable the measurement to be made, including the provision of scaffolding where necessary, and the provision of facilities such as electrical connections to enable the sampling equipment to be used. The local authority must provide the sampling equipment and conduct the test entirely at its own expense.

In various circulars and publications, the Ministry of Housing and Local Government, and the Working Party have emphasised that the measurement of grit and dust emissions is both time consuming and costly. It is unlikely, therefore, that local authorities will authorise the indiscriminate service of hundreds of notices on industrialists, but will concentrate in the first instance on those units which are thought to be giving rise to complaint of nuisance, or which they suspect are emitting solids grossly in excess of the proposed limits. In any event the majority of local authorities have still to arrange for their staff to be trained in the use of the sampling equipment.

D Fume Emission

Fumes are defined in the 1968 Act as "any airborne solid matter smaller than dust", and by this definition acid mist or liquid droplets are thereby excluded.

By virtue of the 1968 amendment to the definition of chimney in the 1956 Act, this now "includes structures and openings of any kind from or through which smoke, grit, dust or fumes may be emitted, and in particular includes flues".

There are, at the moment, no legal provisions which require the reduction or elimination of fume emissions, other than those specific fumes which are controlled by the Alkali Inspectors under the provision of the Alkali &c. Works Regulation Act 1906, as amended and extended by the Clean Air Acts 1956 and 1968, and by the Alkali Works Order 1966.

An important provision in the 1968 Act for possible future consideration is the power in Section 7 of the Secretary of State to apply to "fumes", certain provisions of the 1956 and the 1968 Acts, i.e. by Regulations the Secretary of State may apply the following provisions to fumes, as they apply to grit, dust or smoke:—

(*a*) **Clean Air Act 1956—Section 3**
  Requirement that new furnaces shall be so far as practicable smokeless "*and fumeless*".

(*b*) **Clean Air Act 1968—Section 2**
  Emissions of grit, dust "*and fumes*" from furnaces (standard levels of emission).

Clean Air Act 1968—Section 3

Requirements to fit arrestment plant (*including fume arrestors*) to new furnaces.

Additionally, the Secretary of State has power to extend certain exemption provisions so that they relate to fume emissions or avoid the need to install fume arrestment plant.

4. MISCELLANEOUS PROVISIONS OF THE CLEAN AIR ACTS 1956 AND 1968 AND THE BUILDING REGULATIONS 1972

A. The Clean Air Act 1956 Section 4—Smoke Density Meters

This Section enables the Secretary of State to make Regulations requiring the installation, maintenance and use of smoke density meters and/or recorders obligatory.

No regulations have yet been made and it is thought that this is because, although smoke density meters can be fairly reliable, they are easily subjected to abuse and the results obtained can be varied almost at will by altering the calibration or failing to clean the viewing glasses, etc., which protect the light source and receiver.

Section 8—Information About Furnaces and Fuel Consumed

The local authority is empowered, by this section, to require an industrialist to supply information within 14 days as to the size of furnaces and fuel consumption but this information, in the vast majority of cases is provided willingly and voluntarily.

Section 18—Colliery Spoilbanks (including Waste Quarry-Shale)

Where a spoilbank is emitting smoke and fumes, or is likely to emit smoke and fumes, the following provisions apply:—

(*a*) **A spoilbank in use as at 5th July 1956, or commenced since that date**

The owner of the mine or quarry is required to employ all practicable means for preventing spontaneous combustion and for preventing emission of smoke and fumes.

(*b*) **A spoilbank the use of which had ceased by 5th July 1956**

If the spoilbank was no longer in use and its control had passed from the owner of the mine or quarry on or before the 5th July, 1956, the problem must be dealt with as a statutory nuisance under the provisions of Part III of the Public Health Act 1936 as amended.

Section 19—Railway Engines

Railway engines are subject to the dark smoke provisions of Section one of the 1956 Act, but are not subject to grit and dust emission provisions, nor to a Smoke Control Order.

Section 20—Vessels

Emission of smoke from vessels has been considered on a previous page.

Section 21—Exemption for Purposes of Investigation and Research

This section gives the local authority power to exempt a particular chimney, boiler or furnace, etc., from varying provisions of the Act when it is expedient to do so, to enable investigations or research relevant to air pollution to be carried out without rendering the applicant liable to proceedings.

If the local authority refuse exemption, the applicant has a right of appeal to the Secretary of State for the Environment.

Section 22—Crown Premises

In the event of excessive emissions of smoke, grit and dust from Crown premises, the local authority should notify the Minister responsible for the premises and he shall take appropriate action to prevent or minimise the emission.

Section 23—Clean Air Council

By means of this section the Secretary of State has established the Clean Air Council with one of his Junior Ministers as Chairman to review progress and obtain advice on air pollution matters. There is also a Clean Air Council for Scotland (Statutory Instrument 1957 No. 766).

Sections 25-29* (Modified and partly repealed by CPA 1974)

These sections are mainly administrative and relate to research and publicity, improper disclosure of information by an officer, penalties for offences under the Act (Some of which have been increased by the Criminal Justice Act 1967), authorisation of works, and enforcement of the Act.

B. The Clean Air Act 1968

The only important provisions of this Act not previously mentioned are contained in section 11 and relate to registered processes under the Alkali Act. The section substantially repeals section 17 of the 1956 Act, and in particular removes the power of the local authority to apply to the Secretary of State for authority to institute proceedings in the event of excessive smoke, grit, dust, etc., from registered processes. It also brings within the control of the Alkali Acts "work subject or potentially subject to the Alkali Act".

Building Regulations—Prevention of Smoke Emission

The Building Regulations 1972, include a section, M2, relating to the prevention of emission of smoke. The full text of the section is:—

> "M2. In any building (other than a building erected under former control) there shall not be installed for the purposes of heating or cooking in that or any other building any appliance which discharges the products of combustion into the atmosphere, unless that appliance is designed to burn as fuel either gas, coke, or anthracite. Provided that nothing in this regulation shall prohibit the installation of:—
>
> (i) a furnace which complies with Section 3 of the Clean Air Act 1956; or

- (ii) an appliance of a class exempted conditionally or unconditionally from the provisions of Section 11 of the Clean Air Act 1956 (which relates to smoke control areas) by any order for the time being in force under subsection (4) of that section; or
- (iii) a solid fuel appliance with a bottom grate unsuitable for burning coke or anthracite but designed so as to be capable of use with an alternative bottom grate which is suitable for burning such fuel.

5. THE CONTROL OF POLLUTION ACT 1974

This Act, *when fully operative*, will

- (i) enable the Ministers to
  - (*a*) regulate the composition of motor fuel,
  - (*b*) impose limits on the sulphur content of oil fuel for use in furnaces etc.
  - (*c*) require local authorities to monitor air pollution as directed by the Minister.
- (ii) Modify the Aklali Act 1906 and the Clean Air Act 1968.
- (iii) Substantially extend and amend the provisions of the Clean Air Acts in relation to
  - (*a*) research and publicity on air pollution,
  - (*b*) obtaining information about emissions to atmosphere.
- (iv) Raise the penalties in the Public Health Acts and Clean Air Acts for offences under Clean Air and related legislation.

Section 75—Regulations about Motor Fuel

This section will enable the Secretary of State to make Regulations limiting the composition and contents of any motor fuel and to prevent or restrict the production, treatment, distribution, import, sale or use of any fuel which fails to comply with the requirements and which is for use in the United Kingdom.

The Secretary of State must consult with various bodies before making the Regulations.

Generally, these provisions will be enforced by the Weights and Measures Authorities, who in England and Wales are the County Councils; certain powers of sampling, power of entry, etc., contained in the Trades Descriptions Act will apply to these provisions.

Section 76—Regulations about Sulphur Content of Oil Fuel

Under these provisions, the Secretary of State will be empowered, after consultation, to limit the sulphur content of a wide range of fuel oils used in inudstry, commerce and in domestic boilers etc.

The section provides flexibility for the Secretary of State to be selective in the controls he imposes.

Local Authorities (and in some cases the Health and Safety Executive) will be responsible for the enforcement of the Regulations in due course.

Section 78—Cable Burning

This section modifies the Alkali Act 1906 (as amended by the Clean Air Act 1968) to create an offence of "cable burning" unless the place at which the burning takes place is registered under the provisions of the Alkali Act. The section specifies that H.M. Alkali and Clean Air Inspectorate have authority to prosecute for an offence under this section, but local authorities must apply to the Secretary of State for permission to do so.

Section 79—Research and Publicity

This section modifies and extends the local authority powers in the 1956 Act to undertake research and publicity projects into air pollution.

They are empowered to serve notices to obtain information on emissions of pollutants and to either themselves enter onto premises to measure and record emissions or to agree with occupiers of premises that they should do the work on behalf of the local authority.

The local authority must, if it wishes to monitor the emissions itself, serve a 21 day notice on the occupier

- (i) specifying the kinds of emissions in question and how it proposes to monitor them,
- (ii) indicating that it will do the necessary work unless the occupier chooses to serve a counter-notice bringing into effect section 80 of the Act (local authority notice requiring the occupier to provide the necessary information within a period of six weeks).

The local authority may not enter onto Alkali Registered Works to monitor emissions, but they may serve a notice under section 80, or may monitor the ambient concentration of pollutants in the atmosphere *without entering the Works.*

A local authority may not publish information obtained

- (i) by monitoring emissions,
- (ii) by service of notice under section 80, or
- (iii) by entering into arrangements with occupiers unless they have previously consulted with the industry or trade in their area and/or with any air pollution experts and/or with amenity organisations as appear to be appropriate.

The material, when published, must not disclose a trade secret except with the consent in writing of the person authorised to disclose it, or with the consent of the Secretary of State.

Section 80—Notices Requiring Information about Air Pollution

The section 80 notices referred to previously are served by the local authority when it requires information about emission of pollutants and requires the occupier of the premises to provide the information himself within six weeks or such longer period as allowed. In relation to Alkali Registered Works, the local authority can require information only of a kind which is being supplied to H.M. Alkali and Clean Air Inspectorate.

Notices may require periodical returns or single event emission data; but if periodical returns are requested, the interval between returns shall be not less than three months, and no one return is to cover a period of more than twelve months.

Section 81—Appeals against Notice

A person on whom a section 80 notice is served may appeal to the Secretary of State

- (*a*) on the grounds that disclosure would
  - (i) unreasonably prejudice some private interest, or
  - (ii) be contrary to public interest, or

(*b*) on the grounds that the information is not readily available and cannot be readily collected without incurring undue expenditure.

The Secretary of State may make Regulations as to appeals under this section including the timing of appeals and the circumstances in which all or any part of the appellant's case may be withheld from the local authority. If the appeal is upheld, the Secretary of State may direct the local authority to withdraw or modify the notice, or to take steps to ensure that prejudicial information is not disclosed to the public.

Section 82—Regulations about Research and Publicity

This section provides powers for the Secretary of State to make wide ranging Regulations to prescribe the manner in which and the methods by which local authorities are to perform their functions under sections 79 and 80 of the Act.

Section 83—Provision by Local Authorities of Information for Secretary of State

These powers enable the Secretary of State after consultation with a local authority to direct it to monitor air pollution and to send the information so obtained to him.

However, if the local authority install apparatus provided in pursuance of a direction, they may claim from the Secretary of State the capital cost of providing and installing the equipment.

SCHEDULE TWO
PENALTIES UNDER CLEAN AIR AND PUBLIC HEALTH LEGISLATION

The Control of Pollution Act substantially increases the **maximum** penalties for offences under Clean Air and Public Health legislation:—

(*a*) **Public Health Act 1936—Part III**
  (i) Non-compliance with an Abatement Notice—increase from £20 to £200,
  (ii) Non-compliance with a Nuisance Order—increase from £50 and £5 per day, to £400 and £50 per day.

(*b*) **Clean Air Act 1956**
  (i) Emission of dark smoke from private dwelling—increase from £20 to £100.
  (ii) Emission of dark smoke from other buildings—increase from £100 to £400 or in the case of a vessel to £1,000.
  (iii) Failure to notify installation of furnace or emission of smoke from a building in a smoke control area—increase from £20 to £100.
  (iv) Unlawful disclosure of information—increase from £100 to £400.
  (v) In other cases where £100 is mentioned, this is increased to £400.
  (vi) In other cases where £20 is mentioned, this is increased to £50.

(*c*) **Clean Air Act 1968**
Generally, the maximum penalties are increased from £100 to £400, but with the one exception relating to the sale of unauthorised fuel in a Smoke Control Area, in which case the maximum penalty is increased from £20 to £100.

SCHEDULE THREE

Amendment to Section 30 of the Clean Air Act 1956

Section 30 of the 1956 Act which provides for an early notification of an offence to be confirmed in writing within 48 hours, is amended so that the offence must be confirmed before the end of *4 days* following the day on which the offence occurred.

Amendment to Section 95 of the Housing Act 1964

Section 95, which allows the local authority to exclude certain designated heating appliances from smoke control grant is now amended to enable the Secretary of State, when confirming an order in which a designation is included, to direct that the designation is modified or removed.

6. HEALTH AND SAFETY AT WORK ETC ACT 1974

1. The main purpose of this Act is to provide a comprehensive and integrated legal and administrative system for securing the health, safety and welfare of persons at work and for protecting other persons against risks to health or safety arising from the activities of persons at work. To this end all the separate Inspectorates and agencies at present involved in these matters have been brought together in a Health and Safety Executive under a Health and Safety Commission. The Commission was set up on 1 October 1974 and the Executive on 1 January 1975.
2. Initially these bodies will be responsible for enforcing the existing mass of legislation (including the Alkali Act 1906 but not the Clean Air Acts), but this legislation will be progressively repealed and replaced by the provisions in the 1974 Act itself and by Health and Safety Regulations made thereunder. On 1 January 1975 those parts of the Alkali Act relating to the appointment and powers of Inspectors were repealed, being superseded by the general powers in the 1974 Act. The remainder of the Alkali Act will be repealed and replaced later this year. (N.B. Certain obsolete sections of the Alkali Act were repealed by the Control of Pollution Act 1974).
3. The concept of best practicable means is retained in section 5(1) of the 1974 Act, which places a general duty on persons in control of premises of a class prescribed under section 1(1)(d) to use the best practicable means for preventing the emission into the atmosphere of noxious or offensive substances and for rendering harmless and inoffensive such substances as may be emitted. The few absolute standards in the Alkali Act will disappear. Best practicable means may be defined for individual processes by the Commission, probably in codes of practice approved by the Secretary of State. The list of registrable processes now contained in the Alkali Ex Works Orders of 1966 and 1971 will be re-promulgated in Health and Safety Regulations. Section 5(2) of the 1974 Act also provides that a list may be prescribed of those substances which shall be deemed to be included within the definition "noxious or offensive".
4. The maximum penalty for breaching the general duty under section 5(1) is, on summary conviction a fine of £400, and on indictment imprisonment for two years and/or an unlimited fine.
5. Local authorities will continue to be responsible for the control of air pollution (including under the Clean Air Acts) from all premises not prescribed under the 1974 Act.
6. The processes currently registrable under the Alkali Act and the list of noxious or offensive gases are as follows:

REGISTRABLE WORKS

Non-Scheduled Works

1. Alkali Works

Works for:

(*a*) The manufacture of sulphate of soda or sulphate of potash, or

(*b*) The treatment of copper ores by common salt or other chlorides whereby any sulphate is formed,
in which muriatic acid gas is evolved.

Scheduled Works

1. Sulphuric Acid Works

Works in which the manufacture of sulphuric acid is carried on by the lead chamber process, namely, the process by which sulphurous acid is converted into sulphuric acid by the agency of oxides of nitrogen and by the use of a lead chamber or by any other process involving the use of oxides of nitrogen.

2. Sulphuric Acid [*Class II*] *Works*

Works in which the manufacture of sulphuric acid is carried on by any process other than the lead chamber process, and works for the concentration or distillation of sulphuric acid.

3. Chemical Manure Works

Works in which the manufacture of chemical manure is carried on, and works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid and works for the granulating of chemical manures involving the evolution of any noxious or offensive gas.

4. Gas Liquor Works

Works [not being sulphate of ammonia works or muriate of ammonia works] in which sulphuretted hydrogen or any other noxious or offensive gas is evolved by the use of ammoniacal liquor in any manufacturing process, and works in which any such liquor is desulphurized by the application of heat in any process connected with the purification of gas.

5. Nitric Acid Works

Works in which the manufacture of nitric acid is carried on and works in which nitric acid is recovered from oxides of nitrogen and works where in the manufacture of any product any acid-forming oxide of nitrogen is evolved.

6. Sulphate of Ammonia Works, and Muriate of Ammonia Works

Works in which the manufacture of sulphate of ammonia or of muriate of ammonia is carried on.

7. Chlorine Works

Works in which chlorine is made or used in any manufacturing process.

8. Muriatic Acid Works

(*a*) Muriatic acid works, or works [not being alkali works as defined in the Act] where muriatic acid gas is evolved either during the preparation of liquid muriatic acid or for use in any manufacturing process or as the result of the use of chlorides in a chemical process;

(*b*) Tinplate flux works, works in which any residue or flux from tinplate works is calcined for the utilization of such residue or flux, and in which muriatic acid gas is evolved; and

(*c*) Salt works, works [not being works in which salt is produced by refining rock salt, otherwise than by the dissolution of rock salt at the place of deposit] in which extraction of salt from brine is carried on, and in which muriatic acid gas is evolved.

9. Sulphide Works

Works in which sulphuretted hydrogen is evolved by the decomposition of metallic sulphides, or in which sulphuretted hydrogen is used in the production of such sulphides, or any works in which sulphuretted hydrogen is evolved as part of a chemical process.

10. Alkali Waste Works

Works in which alkali waste or the drainage therefrom is subjected to any chemical process for the recovery of sulphur or for the utilization of any constituent of such waste or drainage.

11. Venetian Red Works

Works for the manufacture of Venetian red, crocus or polishing powder, by heating sulphate or some other salt of iron.

12. Lead Deposit Works

Works in which the sulphate of lead deposit from sulphuric acid chambers is dried or smelted.

13. Arsenic Works

Works for the preparation of arsenious acid, or where nitric acid or a nitrate is used in the manufacture of arsenic acid or an arseniate and works in which any volatile compound of arsenic is evolved in any manufacturing process and works in which arsenic is made.

14. Nitrate and Chloride of Iron Works

Works in which nitric acid or a nitrate is used in the manufacture of nitrate or chloride of iron.

15. Bisulphide of Carbon Works

Works for the manufacture, use or recovery of bisulphide of carbon.

16. Sulphocyanide Works

Works in which the manufacture of any sulphocyanide is carried on by the reaction of bisulphide of carbon upon ammonia or any of its compounds.

17. Picric Acid Works

Works in which nitric acid or a nitrate is used in the manufacture of picric acid.

18. Paraffin Oil Works

Works in which crude shale oil is refined.

19. Bisulphite Works

Works in which sulphurous acid is used in the manufacture of acid sulphites of the alkalis or alkaline earths and works for the manufacture of liquid sulphur dioxide or of sulphurous acid or of any sulphite and works [not being smelting works as defined in section 8, sub-section [1] of the Act of 1906 or other works defined elsewhere in this schedule] in which oxides of sulphur are evolved in any chemical manufacturing process.

20. Tar Works

Works where gas tar or coal tar is distilled or is heated in any manufacturing process and works in which creosote or any other product of the distillation of gas tar or coal tar is distilled or is heated in any manufacturing operation involving the evolution of any noxious or offensive gas.

21. Zinc Works

Works in which by the application of heat, zinc is extracted from the ore, or from any residue containing that metal, and works in which compounds of zinc are made by dry processes giving rise to fume.

22. Benzene Works

Works [not being tar works as already defined] in which any wash oil used for the scrubbing of coal gas is distilled, or in which any crude benzol is distilled.

23. Pyridine Works

Works in which pyridine or picolines are recovered or made.

24. Bromine Works

Works in which bromine is made or is used in any manufacturing operation.

25. Hydrofluoric Acid Works

Works in which hydrofluoric acid is evolved in the manufacture of liquid hydrofluoric acid or its compounds.

26. Cement Production Works

Works in which argillaceous and calcareous materials are used in the production of cement clinker and works in which cement clinker is ground or cement is packed.

27. Lead Works

Works [not being works for the recovery of lead from scrap by direct liquation] in which, by the application of heat, lead is extracted from any material containing lead or its compounds, and works in which compounds of lead are manufactured from metallic lead or its compounds by dry processes which give rise to dust or fume.

28. Fluorine Works

Works in which fluorine or its compounds with other halogens are made or used in any manufacturing process, and works for the manufacture of fluorides, borofluorides or silicofluorides.

29. Acid Sludge Works

Works in which acid sludge produced in the refining of coal tar, petroleum or other hydrocarbon derivatives is treated in such manner as to cause the evolution of any noxious or offensive gas.

30. Iron Works and Steel Works

Works in which:

(*a*) iron or ferro-alloys are produced in a blast furnace and in which raw materials for use in blast furnaces are handled or prepared; or
(*b*) iron ores for use in blast furnaces are calcined or sintered; or
(*c*) iron or steel is melted in cupolas employing a heated air blast, or in electric arc furnaces; or
(*d*) steel is produced, melted or refined in Bessemer, Tropenas, open hearth or electric arc furnaces; or
(*e*) oxygen or air enriched with oxygen is used for the refining of iron or for the production, shaping or finishing of steels; or
(*f*) ferro-alloys are made by processes giving rise to fume.

31. Copper Works

Works in which:

(*a*) by the application of heat
  (i) copper is extracted from any ore or concentrate or from any material containing copper or its compounds; or
  (ii) molten copper is refined; or
  (iii) copper or copper alloy swarf is degreased; or
  (iv) copper alloys are recovered from scrap fabricated metal, swarf or residues by processes designed to reduce the zinc content; or
(*b*) copper or copper alloy is melted and cast in moulds the internal surfaces of which have been coated with grease-bound or oil-bound dressings. [But this paragraph does not apply to works in which the aggregate casting capacity does not exceed 10 tons per day.]

32. Aluminium Works

Works in which:

(*a*) aluminium swarf is degreased by the application of heat; or
(*b*) aluminium or aluminium alloys are recovered from aluminium or aluminium alloy scrap fabricated metal, swarf, skimmings, drosses or other residues by melting but not including works in which aluminium or aluminium alloys are separated from ferrous metals by liquation in sloping heater furnaces; or
(*c*) aluminium is recovered from slag; or
(*d*) molten aluminium or aluminium alloys are treated by any process involving the evolution of chlorine or its compounds; or
(*e*) aluminium is extracted from any material containing aluminium by a process evolving any noxious or offensive gases; or
(*f*) oxide of aluminium is extracted from any ore

and materials used in the above processes or the products thereof are treated or handled by methods which cause noxious or offensive gases to be evolved.

33. Electricity Works

Works in which:

(*a*) solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of public transport; or
(*b*) boilers having an aggregate maximum continuous rating of not less than 450,000 lbs. of steam per hour and normally fired by solid or liquid fuel are used to produce steam for the generation of electricity for purposes other than those mentioned in the preceding paragraph.

34. Producer Gas Works

Works in which producer gas is made from coal and in which raw producer gas is transmitted or used.

35. Gas and Coke Works

Works [not being producer gas works] in which:

(*a*) coal, oil or mixtures of coal or oil with other carbonaceous materials or products of petroleum refining or natural gas or methane from coalmines or gas derived from fermentation of carbonaceous materials are handled or prepared for carbonisation or gasification or reforming and in which these materials are subsequently carbonised or gasified or reformed; or
(*b*) Water gas is produced or purified; or
(*c*) coke or semi-coke is produced and quenched, cut, crushed or graded; or
(*d*) gases derived from any process mentioned in paragraph (*a*) are subjected to purification processes.

36. Ceramic Works

Works in which:

(*a*) pottery products [including domestic earthenware and china sanitary ware, electrical porcelain, glazed tiles and teapots] are made in intermittent kilns fired by coal or oil; or

(*b*) heavy clay or refractory goods are fired by coal or oil in
  (i) intermittent kilns; or
  (ii) continuous grate-fired kilns, not being tunnel kilns; or
  (iii) any kiln in which a reducing atmosphere is essential; or

(*c*) salt glazing of any earthenware or clay material is carried on.

37. Lime Works

Works in which calcium carbonate or calcium-magnesium carbonate is burnt through the agency of coal or oil.

38. Sulphate Reduction Works

Works in which metallic sulphates are reduced to the corresponding sulphides by heating with carbonaceous matter.

39. Caustic Soda Works

Works in which:

(*a*) either concentrated solutions of caustic soda or fused caustic soda are produced in vessels heated by coal; or

(*b*) black liquor produced in the manufacture of paper is calcined in the recovery of caustic soda.

40. Chemical Incineration Works

Works for the destruction by burning of wastes produced in the course of organic chemical reactions which occur during the manufacture of materials for the fabrication of plastics and fibres, and works for the destruction by burning of chemical wastes containing combined chlorine, fluorine, nitrogen, phosphorus or sulphur.

41. Uranium Works

Works [not being works licensed under the Nuclear Installations [Licensing and Insurance] Act, 1959, and not being nuclear reactors or works involving the processing of irradiated fuel therefrom for the purpose of removing fission products] in which:

(*a*) any ore or concentrate or any material containing uranium or its compounds is treated for the production of uranium or its alloys or its compounds; or

(*b*) any volatile compounds of uranium are manufactured or used; or

(*c*) uranium or its compounds are manufactured, fashioned or fabricated by any dry process giving rise to dust or fume.

42. Beryllium Works

Works in which:

(*a*) any ore or concentrate or any materal containing beryllium or its compounds is treated for the production of beryllium or its alloys or its compounds; or,

(*b*) any material containing beryllium or its alloys or its compounds is treated, processed or fabricated in any manner giving rise to dust or fume.

43. Selenium Works

Works in which:

(*a*) any ore or concentrate or any material containing selenium or its compounds is treated for the production of selenium or its alloys or its compounds; or

(*b*) any material containing selenium or its alloys or its compounds other than as colouring matter is treated, processed or fabricated in any manner giving rise to dust or fume.

44. Phosphorus Works

Works in which:

(*a*) phosphorus is made; or

(*b*) yellow phosphorus is used in any chemical or metallurgical process.

45. Ammonia Works

Works in which ammonia is:

(*a*) made; or

(*b*) used in the ammonia-soda process; or

(*c*) used in the manufacture of carbonate, nitrate or phosphate of ammonia or urea or nitriles.

46. Hydrogen Cyanide Works

Works in which hydrogen cyanide is made or is used in any chemical manufacturing process.

47. Acetylene Works

Works in which acetylene is made and used in any chemical manufacturing process.

48. Amines Works

Works in which:

(*a*) any methylamine or any ethylamine is made; or

(*b*) any methylamine or any ethylamine is used in any chemical process.

49. Calcium Carbide Works

Works in which calcium carbide is made.

50. Aldehyde Works

Works in which formaldehyde, acetaldehyde or acrolein or the methyl, ethyl or propyl derivate of acrolein are made.

51. Anhydride Works

Works in which acetic, maleic or phthalic anhydrides or the corresponding acids are made.

52. Chromium Works

Works in which any chrome ore or concentrate is treated for the production therefrom of chromium compounds or chromium metal is made by dry process giving rise to fume.

53. Magnesium Works

Works in which magnesium or any compound of magnesium is made by dry processes giving rise to fume.

54. Cadmium Works

Works in which metallic cadmium is recovered or cadmium alloys are made or any compound of cadmium is made by dry processes giving rise to fume.

55. Manganese Works

Works in which manganese or its alloys or any compound of manganese is made by dry processes giving rise to fume.

56. Metal Recovery Works

Works in which metal is recovered from scrap cable by burning the insulation.

57. Petroleum Works

Works in which:

(*a*) crude petroleum is handled or stored; or

(*b*) crude petroleum is refined by any operation carried out at petroleum refineries to convert crude petroleum into saleable products; or

(*c*) any product of such refining is subjected to further refining; or

(*d*) natural gas is refined; or

(*e*) any product of any of the foregoing operations is used, except as a solvent, in any subsequent chemical manufacturing process, not being a chemical manufacturing process described in any other scheduled work; or

(*f*) used lubricating oil is prepared for re-use by any thermal process.

58. Acrylates Works

Works in which acrylates are:

(*a*) made; or

(*b*) purified; or

(*c*) made or purified and polymerised.

59. Di-isocyanates Works

Works in which di-isocyanates are made, or partly polymerised or used in the manufacture of expanded plastics.

60. Mineral Works

Works in which metallurgical slags or pulverised fuel ash, or minerals are subjected to any size reduction, grading or heating by processes giving rise to dust, including the subsequent handling of the products of any such process but not including works for the processing of coal, lime works, ceramic works or foundries except in so far as the process carried on is described in any other scheduled work.

61. Smelting Works

Works in which sulphide ores, including regulus, are calcined or smelted.

NOXIOUS OR OFFENSIVE GASES

Muriatic acid
Sulphuric acid and sulphuric anhydride
Sulphurous acid and sulphurous anhydride [except those arising solely from the combustion of coal]
Nitric acid and acid forming oxides of nitrogen
Chlorine and its acid compounds
Bromine and its acid compounds
Iodine and its acid compounds
Fluorine and its compounds
Arsenic and its compounds
Ammonia and its compounds
Cyanogen compounds
Pyridine
Bisulphide of carbon
Chloride of sulphur
Acetylene
Sulphuretted hydrogen
Volatile organic sulphur compounds
Fumes from benzene works
Fumes from cement works
Fumes from tar works
Fumes from paraffin oil works
Fumes from petroleum works
Fumes containing copper, lead, antimony, arsenic, zinc, aluminium, iron, silicon, calcium, or their compounds
Fumes containing chlorine or its compounds
Smoke, grit and dust
Fumes containing uranium, beryllium, cadmium, selenium, sodium, potassium or their compounds
Carbon monoxide
Acetic anhydride and acetic acid
Acrylates
Aldehydes
Amines
Di-isocyanates
Fumes containing chromium, magnesium, manganese, molybdenum, phosphorus, titanium, tungsten, vanadium or their compounds
Maleic anhydride, maleic acid and fumaric acid
Products containing hydrogen from the partial oxidation of hydrocarbons
Phthalic anhydride and phthalic acid
Picolines

7. ROAD TRAFFIC POLLUTION LAW

Reflecting a worldwide trend, over the last few years controls over emissions of gaseous pollutants from petrol-driven vehicles and the use of lead as an additive in petrol have been added to those which previously existed in the U.K. over diesel exhaust emissions. All these controls except those over the lead content of petrol, which are not yet included in Regulations, are implemented by the Motor Vehicles (Construction and Use) Regulations 1973.

For the purpose of limiting or reducing air pollution, the Control of Pollution Act, passed in July 1974 ,enables the Secretary of State to issue Regulations imposing requirements as to the composition and contents of any kind of fuel used in motor vehicles; but no such Regulations have yet been issued.

Diesel Engined Vehicles

A number of Regulations are relevant to diesel exhaust smoke. At the manufacturing stage, all vehicles must be so constructed that they emit no avoidable smoke or visible vapour, and other "construction" Regulations apply particularly to diesel engined vehicles. Each new diesel engine for use in a road vehicle must be of a type which has been certified to a British Standard (B.S. A.U.141a) which lays down maximum permissible smoke capacity values for exhaust gases produced over a wide range of engine conditions. Also, excess fuel devices ("chokes") on diesel engines must be so fitted that they cannot be used while vehicles are in motion, if their use could increase the engine's smoke out-put. Since 1968 the Regulations have required most commercial vehicles to be fitted by their manufacturers with a plate showing particulars of weights and other matters, and the figures on the plate must show that a minimum power/weight ratio is being maintained. In use, no vehicle may emit smoke, vapour, dust, grit or other substances so as to endanger other road users, and engines must not be altered or adapted in a way which increases their smoke output.

Petrol Engined Vehicles

Except for small three-wheeled cars and some exempted models, all petrol engined cars and light commercial vehicles first used on or after 10th November 1973, and manufactured on or after 20th September 1973, must comply with the limits laid down for emissions of hydrocarbons and carbon monoxide in Regulation No. 15 of the United Nations' Economic Commission for Europe.

The actual tests prescribed by ECE Regulation 15 require that the car shall be tested on a chassis dynamometer by a cycle of conditions representing driving in a congested urban area after a cold start. The maximum permissible mass of CO and HCs are set out in a table relating them to the weight of the vehicle concerned.

A second test will be the measurement of the percentage of carbon monoxide at idling speed with a hot engine. The volume of CO content of the exhaust gases must not exceed 4.5%.

Compliance with this Regulation must be attested by an approval mark, legibly and indelibly affixed to the vehicle. Reductions of up to 30% in carbon monoxide and up to 35% in hydrocarbons, compared to an uncontrolled vehicle, result.

In 1972 the Secretary of State for the Environment announced a programme of phased reductions in the permissible lead content of petrol. From a level of .84 grammes per litre in 1972, in November 1974 the permitted content was reduced to .55 grammes per litre.

Policy for Anti-Pollution Legislation on Motor Vehicles

So far, research has not shown that current levels of emission from motor vehicles offer any threat to health, although pollutants such as lead and carbon monoxide are undesirable since they are toxic in high concentrations, and their effects must be closely monitored. Current legislation will prevent total emissions from motor vehicles from rising significantly above present levels as vehicle population and total fuel usage increase. An agreement has been reached in E.E.C. and E.C.E. to reduce the emission levels of carbon monoxide by 20% and those of hydrocarbons by some 15%. Meanwhile research continues and further measures will be taken when the need for them is established.

THE BRITISH STANDARD RINGELMANN CHART AND THE BRITISH STANDARD MINIATURE SMOKE CHART

The method of visual assessment of smoke emission by comparison of the darkness of the smoke with the standard shades of grey on a chart placed in a suitable position was devised by Professor Ringelmann of Paris towards the end of the 19th century. Professor Ringelmann obtained the shades of grey by cross-hatching in black on a white background so that a known percentage of the white was obscured.

The British Standard Ringelmann Chart (B.S.2742C) see figure 1, is printed for the British Standard Institution so that the shades obtained in use are both consistent and near the average to those which users were accustomed when using the previously available commercially-printed Ringelmann Charts, including those issued by the U.S. Bureau of Mines.

The Chart consists of a cardboard sheet 581 mm × 127 mm on which are printed five 101 mm (4″) squares, four of which are cross-hatched by 20 horizontal and 20 vertical lines so that in use the cross-hatched black lines merge into the white background and produce for each shade, apparently, a uniform grey. For an average observer, the Chart must be placed more than 15 metres distant to produce the uniform shade.

The numbers of the shades—the Ringelmann numbers—range from 0 to 5; each shade increasing by comparison with the previous number by 20% obscuration so that

Ringelmann 1 = 20% obscuration
Ringelmann 2 = 40% obscuration
Ringelmann 3 = 60% obscuration
Ringelmann 4 = 80% obscuration

Ringelmann 5 (100% obscuration) is not reproduced on BS.2742C, and the black strip is included only for control during printing.

"Dark smoke" is smoke which is as dark as or darker than shade 2 on the Chart.

"Black smoke" is smoke which is as dark as or darker than shade 4 on the Chart.

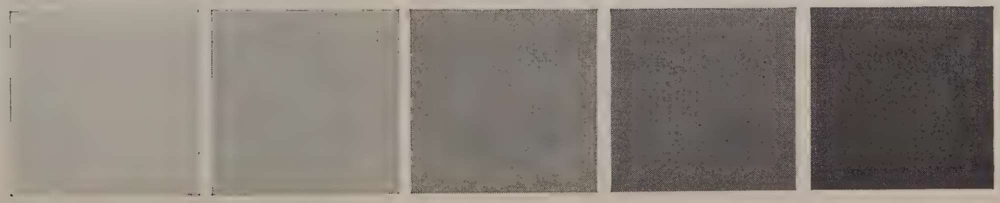
The Use of the Ringelmann Chart.

The use of the Ringelmann and Miniature Smoke Charts (see below) is described in BS.2742:1969.

The Ringelmann Chart should be firmly mounted onto a backing holder—aluminium is suitable—similar to that described in BS.2742. Protective coverings must *not* be applied to the Chart in use and nothing should impair the luminance of its working surface.

It should be used under daylight conditions and held in a vertical plane in line between the observer and the chimney top, at a distance of more than 15 metres to ensure the cross-hatched lines merge into shades of grey.

Where possible the general illumination of the sky should be uniform, but if the sun is shining or the sky bright on one side, the British Standard recommends that the bright source of illumination should be approximately at right angles to the line of vision and not in front of or behind the observer. Under hazy conditions observations should not be taken at extreme distance as there will be a tendency for the readings to be low. The angle of view of the Chart and smoke should be as low as possible; observations at a steep angle should be avoided.



A half-tone reproduction of the Miniature Smoke Chart

The darkness of the smoke at the chimney terminal should be compared with the Chart; the Ringelmann number which most closely matches the darkness of the smoke, and the time and duration of the emission should be noted. In favourable conditions it is possible to estimate smoke darkness to the nearest quarter Ringelmann.

The Miniature Smoke Chart (BS.2742M)

Because of the situations in which the British Standard Ringelmann Chart cannot be used, the British Standards Institution has developed the Miniature Smoke Chart.

The Miniature Smoke Chart is a small card 129 mm × 69 mm on which are printed shades of grey so that in use the shades correspond to the shades of the BS. Ringelmann Chart produced by the merging cross-hatching. The Standard indicates that, at this stage, the Miniature Smoke Chart is not intended for use as a substitute for the Ringelmann Chart; but in practice with an experienced observer the results obtained by use of either Chart are identical.

Since the Chart is slightly translucent, it should be backed with white opaque material or placed in a holder.

The Standard recommends that the Chart should be held at a distance of 1.5 metres from the eye in a holder on the end of a light rod; but also indicates that it can be held at arm's length—with some reservation on the accuracy of the readings obtained.

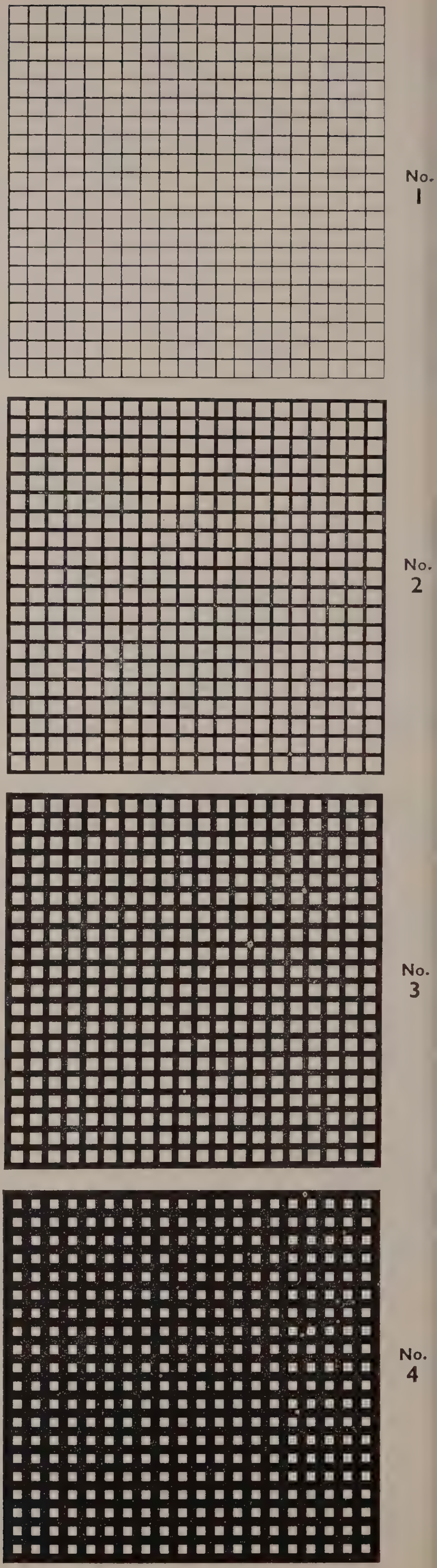
In other respects—lighting, angle of view, etc.—the Miniature Smoke Chart should be used similarly to the British Standard Ringelmann Chart.

The Microringelmann Chart.

This is a card 127 mm × 84 mm on which are printed an accurate photographic reduction of the cross-hatched Ringelmann shades 1 to 4, above and below a horizontal slot through which the chimney top is viewed. The lines almost merge to a shade when, in use, the Chart is held at arm's length.

The recommended method of use is different from that of the British Standard Charts in that with the Microringelmann the sun should be behind the observer.

The Chart is printed with a reflective surface and great care is required to obtain an accurate assessment of smoke colour. Some experienced observers consider that the use of the Microringelmann Chart should not now be recommended because of this difficulty.



A photographic reproduction of the chart

British Standards Relating to Air Pollution

B.S.

349 Identification of Contents of industrial gas containers 1973. Specifies the marking and colour of industrial gas containers to identify their contents. 349 C 1973 Chart for identification of contents of gas containers.

350 Conversion factors and Tables.
Part 1: 1959. Basis of tables, conversion factors. Subject of measurement—Metrology, Mechanics, Heat. Information on units, tables of units, conversion factors.
Part 2: 1962. Detailed conversion tables. Amendment 1969.

758 Small domestic hot-water supply boilers using solid fuel. (Parts 1 & 2 withdrawn, superseded by BS 4433: Part 1.)

799 Oil burning Equipment.
Part 1: 1962. Atomising burners and associated equipment.
Part 2: 1964. Vapourising burners and associated equipment.
Part 3: 1970. Automatic and semi-automatic atomising burners up to 36 litres per hour and associated equipment.
Part 4: 1972. Atomising burners over 36 litres per hour and associated equipment for single and multi-burner installations.

893 Methods of testing dust extraction plant and the emission of solids from chimneys of electric power stations 1940. Amendment PD 26, September 1942.

1016 Methods for the Analysis and testing of coal and coke.
Part 2: 1957. Total Moisture of coke—methods of determining. Amendment PD 5883, July 1966.

1017 The Sampling of Coal and Coke.
Part 1: 1960. COAL Amendments PD 3796, May 1960; PD 4649, September 1962.
Part 2: 1960. COKE Amendments PD 4366, October 1961; PD 4650, September 1962.

1250 Domestic appliances burning town gas.
Part 1: 1966. General Requirements.
Part 2: 1963. Cooking appliances. Amendment PD 5391, November 1964.
Part 3: 1963. Water-heating appliances. Amendment PD 5852, June 1966.
Part 4: 1965. Space heating appliances.
Part 5: 1963. Refrigerators. Amendments PD 5449, January 1965; PD 5587, July 1965.
Part 6: 1965. Laundering appliances. Amendment PD 5805, March 1966.

1251 Open fireplace components. Amendments AMD 903, March 1972. Four sections dealing with dimensional, constructional and other requirements for:

1. Firebacks for 350mm, 400mm and 450mm open fires.
2. Fireplace surrounds and hearths.
3. Adjustable chimney-throat restrictors.
4. Lintels for open fire assemblies.

B.S.

1252 Domestic solid fuel cookers with integral boilers, 1957. Amendments PD 3383, May 1959; PD 4212, July 1961; PD 4822, February 1963.
General performance requirements.

1334 The use of thermal insulating materials for central heating and hot and cold water supply installations. 1969 (Metric).

1344 Methods of testing vitreous enamel finishes.
Part 3: 1967. Resistance to products of combustion containing sulphur compounds (Metric).

1747 Methods for the measurement of air pollution.
Part 1: 1969. Deposit gauges (Metric).
Part 2: 1969. Determination of concentration of suspended matter (Metric).
Part 3: 1969. Determination of sulphur dioxide (Metric).
Part 4: 1969. The lead dioxide method (Metric).
Part 5: 1972. Directional dust gauges (Metric).

1756 Methods for the sampling and analysis of flue gas 1971.
Part 1: 1971. Methods of sampling (Metric).
Part 2: 1971. Analysis by the Orsat apparatus (Metric).
Part 3: 1971. Analysis by the Haldane apparatus (Metric).
Part 4: 1965. Miscellaneous analysis (Metric). Amendment PD 5858, June 1966.
Part 5: 1971. Semi-routine analyses (Metric).

1816 Heavy duty cooking ranges (solid fuel) 1957. Amendment PD 2814, May 1957.

1831 Recommended common names for pesticides. Supplements 1 and 2.

1846 Glossary of terms relating to solid fuel burning equipment.

1945 Fireguards for heating appliances (gas, electric and oil-burning). Amendment AM D 940, April 1972.

2069 Gas sampling tubes 1954.

2486 Treatment of water for land boilers—includes glossary of terms used in water treatment.

2520 Barometer conventions and tables 1967.

2740 Simple smoke alarms and alarm metering devices 1969. Amendment AMD 985, June 1972 (Metric).

2741 Recommendations for the construction of simple smoke viewers. 1969 (Metric).

2742 Notes on the use of the Ringelmann and miniature smoke charts, 1969 (Metric). Addendum No. 1: 1972. The calibration of instruments in Ringelmann numbers.

B.S.

2742C Ringelmann Chart, 1957.

2742M Miniature smoke chart, 1960.

2773 Domestic single-room space heating appliances for use with liquefied petroleum gases 1965 (Metric). Amendment PD 5779, February 1966.

2811 Smoke density indicators and recorders 1969. Amendment AMD 986, June 1972 (Metric).

2831 Methods of test for air filters used in air conditioning and general ventilation. 1971.

2845 Coke burning inset open fires without boiler and without convection 1957 (withdrawn, superseded by, BS 4834).

2852 Rating and testing room air conditioners 1970 (Metric).

2878 Methods for determination of lead in gasoline (gravimetric method) 1968 (Metric).

3048 Code for the continuous sampling and automatic analysis of flue gases. Indicators and recorders. 1958. (Complementary to BS 1756, which covers manually operated instruments.)

3107 Small incinerators for the destruction of hospital dressings. 1959.

3128 Constructional and performance requirements for 1959 inset open fires with boiler and without convection (withdrawn, superseded by BS 4834).

3142 Manufactured solid smokeless fuels for household use (Metric).
Part 1: 1965. Cokes for domestic open fires.
Part 2: 1965. Cokes for domestic closed appliances.
Part 3: 1970. Specially reactive fuels for all types of domestic open fire.

3156 Methods for the analysis of fuel gases.
Part 1: 1968. General analysis (Metric).
Part 2: 1968. Special determinations (Metric). Amendments AMD 120, October 1968; AMD 512, May 1970.
Part 3: 1968. Combustion characteristics (Metric).
Part 4: 1969. Gas chromatographic analysis (Metric).
Part 5: 1969. Techniques for high pressure gases (Metric). Amendments AMD 565, August 1970.

3198 Combination hot water storage units (copper) for domestic purpose 1960. Amendments PD 6395, April 1968; AMD 224, March 1969.

3250 The thermal testing of domestic solid fuel burning appliances with convection.
Part 1: 1960. Flue loss method. Amendment PD 5140, February 1964.
Part 2: 1961. Hood method. Amendment PD 4205, June 1961.

3300 Kerosene (paraffin) unflued space heaters, cooking and boiling appliances for domestic use. 1963. Amendments PD 5224, May 1964; PD 5912, September 1966; PD 6247, September 1967; AMD 115, October 1968; AMD 240, May 1969.

3328 Domestic gas pokers and portable underbar ignition burners 1961.

3376 Open fires with convection, with or without boiler 1961.

B.S.

3377 Back boilers for use with domestic solid fuel appliances 1969 (Metric).

3378 Room heaters burning solid fuel 1972 (Metric). Amendment AMD 1199, June 1973.

3405 Simplified methods for measurement of grit and dust emission 1971 (Metric).

3446 Glossary of terms relating to the manufacture and use of refractory materials 1962.

3456 Safety of household electrical appliances.
Part A: Heating and cooking appliances. Section A1 1966. General requirements. Amendments PD 6250, September 1967; AMD 181, January 1969; AMD 521, May 1970; AMD 914, March 1972. Section A2 1962, Electric room heaters. Amendments PD 4929, May 1963; PD 5054, October 1963; PD 5203, April 1964; AMD 51, August 1968; AMD 281, July 1969; AMD 538, June 1970.
Section A8 1963. Electric immersion heaters. Amendments AMD 154, November 1968; AMD 392, December 1969.
Section A11 1966. Thermal storage room heaters. Amendments AMD 61, August 1968; AMD 792, August 1972, will be superseded by section 2.26 (in course of preparation).
Section A12 1962. Electric cookers and boiling plates. Amendments PD 5491, March 1965; PD 5649, September 1965; AMD 26, July 1968; AMD 184, January 1969, AMD 279, July 1969; AMD 563, August 1970; AMD 803, September 1971; AMD 973, June 1972, this section will be withdrawn in September 1974 and superseded by Section 2.1.

3456 Part C: Electrical refrigerators and food freezers 1967 (Metric). Amendments AMD 412, January 1970; AMD 662, December 1970; AMD 1138, May 1973. Will eventually be withdrawn and superseded by Section 2.24.

3456 Section 2.22. Electricaire heaters 1972 (Metric).

3456 Section 2.23. Cooker ventilating hoods 1971 (Metric).
Section 2.29. Ventilating fans 1971 (Metric).
Section 2.30. Food waste disposal units 1971 (Metric).

3755 Methods of test for the assessment of odour from packing materials used for foodstuffs. Amendment AMD 684, March 1971.

3841 Method for the assessment of smoke from manufactured solid fuels for domestic open fires 1972 (Metric).

3879 Portable liquefied petroleum gas appliances operating at vapour pressure from small LPG containers 1969 (Metric).

3929 Domestic solid fuel ignition pokers and portable undergrate ignition burners for use with commercial butane 1965.

3955 Electrical controls for domestic appliances.
Part 1: 1965. General requirements. Amendments AMD 12, June 1968; AMD 459, March 1970.
Part 2: Specific requirements.
Section 2A: 1967. Manually operated appliance switches. Amendments AMD 13, June 1968; AMD 436, February 1970.

3955 Section 2B: 1966. Thermostats for electrically heated hot water supply. Amendments AMD 14, June 1968; AMD 437, February 1970.

B.S.

3958 Thermal insulating materials.
Part 1: 1970. 85 per cent magnesia preformed insulation. Amendment AMD 929, April 1972 (Metric).
Part 2: 1970. Calcium silicate preformed insulation. Amendment AMD 930, April 1972 (Metric).
Part 3: 1967. Metal mesh faced mineral wool mats and mattresses (Metric).
Part 4: 1968. Bonded preformed mineral wool pipe sections. Amendment AMD 145, November 1968 (Metric).
Part 5: 1969. Bonded mineral wool slabs (for use at temperatures above 50°C) (Metric).
Part 6: 1972. Finishing materials; hard setting composition, self-setting cement and gypsum plaster (Metric).

4076 Steel chimneys 1966. Amendment AMD 1002, August 1972.

4201 Thermostats for gas burning appliances 1969. Amendment AMD 447, February 1970 (Metric).

4207 Monolithic lungs for steel chimneys and flues 1967 (Metric).

4256 Oil burning air heaters.
Part 1: 1972. Non-domestic, transportable, fan assisted heaters (Metric).
Part 2: 1972. Fixed, flued fan assisted heaters (Metric).
Part 3: 1972. Fixed, flued, convector heaters (Metric).

4350 Method for determination of sulphur in petroleum products (lamp method) 1971 (Metric).

4379 Determination of calorific value of liquid fuel 1969.

4433 Independent thermostatically controlled central heating boilers, with rated outputs up to 44 kW 1969.
Part 1: 1973. Boilers with undergrate ash removal. Superseded BS 758: Parts 1 and 2.
Part 2: 1969. Gravity feed boilers designed to burn small anthracite (Metric).

4543 Factory made insulated metal chimneys 1970. Amendments AMD 749 June 1971; AMD 919, March 1972.

4555 High efficiency dust respirators 1970.

4558 Positive pressure, powered dust respirators 1970.

4642 Glossary of industrial furnace terms 1970.

4834 Inset open fires without convection 1972 (Metric).

CODES OF PRACTICE

CP3 Chapter III. Sound insulation and noise reduction.
Part 1: 1960. Imperial units. Amendment AMD 956, April 1972.
Chapter X, 1950. Precautions against vermin and dirt.

CP94 1971. Demolition. Amendment AMD 1090, January 1973 (Metric).

B.S.

CP131 101 1951. Flues for domestic appliances burning solid fuel. Amendment PD 1445, July 1952.

CP331 Installation of pipes and meters for town gas.
Part 1: 1957. Service pipes. Amendment PD 3115, July 1958; PD 5606, August 1965.
Part 2: 1965. Metering and meter control.
Part 3: 1965. Installation pipes.

CP332 Selection and installation of town gas space heating.
Part 1: 1961. Independent domestic appliances. Amendment PD 5611, August 1965.
Part 2: 1964. Central heating boilers for domestic premises. Amendment PD 5612, August 1965; AMD 529, June 1970.
Part 3: 1970. Boilers of more than 150,000 Btu/h (44kW) and up to 2,000,000 Btu/h (586kW) output.
Part 4: 1966. Ducted warm air systems. Amendment AMD 355, November 1969.

CP333 Selection and installation of town gas hot water supplies.
Part 1: 1964. Domestic premises. Amendment PD 5608, August 1965.
Part 2: 1948. Schools. Amendment PD 5609, August 1965.

CP334 Selection and installation of town gas cooking and refrigerating appliances.
Part 1: 1962. Domestic cooking appliances. Amendment PD 5613, August 1965.
Part 2: 1966. Cooking installations for educational establishments.
Part 3: 1971. Refrigerators (Metric).

CP335 Selection and installation of miscellaneous town gas appliances.
Part 1: 1960. Laundering and miscellaneous domestic appliances. Amendment PD 4161, May 1961, PD 5616, August 1965.

CP403 1952. Open fires, heating stoves and cookers burning solid fuel. 403.101: 1952. Small boiler systems using solid fuel.

CP 3000 1965. Installation and maintenance of underfeed stokers.

CP Oil firing.

3002 Part 1: 1961. Installations burning class D fuel oil and CTF 50. Amendment PD 4758, December 1962.
Part 2: 1964. Installations burning class C and class D fuels oils for vaporising burners.
Part 3: 1965. Installations burning pre-heated fuels. Class E, F and G fuel oils and C.T.F. 100 to 250.

CP Central heating for domestic premises.

3006 Part 1: 1969. How pressure forced circulation hot water (small bore) systems. Amendment AMD 465, March 1970.

A11 141a 1971: The performance of diesel engines for road vehicles (Metric).

GLOSSARY OF TERMS RELATING TO AIR POLLUTION

This Glossary of terms is intended to help members of the Society and others interested in Air Pollution to understand technical articles and lectures, etc. on the subject. After some thought it has been decided not to produce a list of precise definitions since to many non-technical people these can sometimes be as incomprehensible as the terms being defined. Instead, an attempt has been made to indicate the general concepts involved in many technical terms so that people can get the feel of these terms in the context in which they occur.

For those seeking precise definitions the World Health Organisation has a much larger Glossary in preparation. This should be published in 1975.

Members of the Technical Committee have offered comments and suggestions during the drafting of the Glossary, but the main tasks of selecting items for inclusion, for writing the definitions and for final editing, have been undertaken by Dr. Reay of Warren Spring Laboratory. The Technical Committee therefore wish to acknowledge with gratitude the considerable personal effort that Dr. Reay has expended on the preparation of the Glossary for which he may rightfully take most of the credit.

Abatement
Reduction or lessening (of pollution) or doing away with (a nuisance).

Absorption
1) The taking up usually of a liquid or gas into the body of another material (the absorbent). Thus for instance an air pollutant may be removed by absorption in a suitable solvent.
2) The taking up of radiation by a material it encounters or passes through. This can be the basis of measuring a number of substances.

Acid
A substance which, in solution in water, splits up to some extent with the formation of hydrogen ions. Strong acids are those which split up to a large degree; they are usually corrosive. Acids neutralise alkalis (q.v.) with the formation of salts.

Acid Dewpoint
The temperature at which dilute sulphuric acid appears as a condensate when a flue gas containing sulphur trioxide is cooled. This is related to the moisture and sulphur trioxide content of the flue gas.

Accuracy
The nearness of a measurement to the true value of the thing being measured (cf. precision).

Acute
Used in relation to the effects of certain concentrations of air pollutants to describe a response coming rapidly to a climax (cf. chronic).

Adiabatic
Without loss or gain of heat.

Adsorption
A phenomenon in which molecules of a substance (the adsorbate) are taken up and held on the surface of a material (the adsorbent) (cf. absorption).

Aerosol
Finely divided solid or liquid particles suspended and dispersed in a gas as in the case of a mist, fog, haze or smoke.

Afterburner
A burner fitted after the main point of fuel combustion in stationary plant or a vehicle to produce more nearly complete combustion and less pollution. It may also be a burner fitted to incinerate polluted process gases.

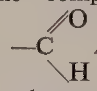
Agglomeration
The clustering or adhering together of a number of small particles to form something (an agglomerate) which then acts as a larger single particle.

Aggregate
There are two common meanings
1) Similar to agglomerate (q.v.) but probably less strongly bonded;
2) Sand and rubble used to make concrete.

Air Quality
Air quality usually refers to the concentration in air of one or more pollutants. For many pollutants air quality will be found to be expressed as a concentration over a certain period of time eg $\mu g/m^3$ over 24 hours.

Air Quality Criteria
See Criteria

Air Pollution
See Pollution

Aldyhydes
Organic compounds containing the group  $-\mathrm{C}{\genfrac{}{}{0pt}{}{/\!\!/\mathrm{O}}{\backslash\mathrm{H}}}$ A number of them have an unpleasant smell, eg in diesel exhaust, and can be irritant to nose and eyes; many can be poisonous.

Alkali/Alkaline
A substance which, in solution in water, splits up to some extent to give rise to an excess of hydroxyl over hydrogen ions. The solution is said to exhibit alkaline properties. Alkalis neutralise acids with the formation of salts.

Alkali Inspectorate
The control of many of the major industrial processes in the UK capable of polluting emissions is vested in H.M. Alkali and Clean Air Inspectorate which enforces the Alkali Etc Works Regulation Acts in England and Wales and in H.M. Industrial Pollution Inspectorate for Scotland.

Allergy
The reaction of the living body to a substance or substances to which certain body cells are supersensitive. The final effect may take the form of local inflammation or tissue damage.

Alveoli
Small pits or depressions on the surface of an organ. In the air pollution literature alveoli refer to very small terminal air sacs in the lung where gaseous exchange takes place between the blood and the air.

Ambient
Surrounding. Used to describe air pollution concentrations in the open air

as against, say, at the point of emission or indoors.

Amenity
Basically this means pleasantness. In air pollution it usually refers to the general quality of the environment as society perceives it distinct from hazards of air pollution which can cause physical damage.

Anemometer
An instrument for measuring wind speed.

Anoxia
A deficiency of oxygen—in the blood or thereby in body tissues.

Anthracite
A high calorific value coal yielding little ash and volatiles—hence low smoke production. It is slow-burning and not normally used on open fires. It is cleaner to handle than most other coals.

Antibody
A specific substance released into the body's system in response to invasion by an antigen (q.v.).

Anticyclone
The condition of atmospheric pressure distribution in which pressure increases towards the centre. Usually associated with fine, calm weather and with fog in winter.

Antiknock Additives
Antiknock additives to petrol allow its use in higher compression ratio engines than otherwise permissible and with greater thermal efficiency without the phenomenon of 'knock' (q.v.). The additives are commonly organic lead compounds.

Antigen
A foreign substance, usually a protein, which, when introduced into the body, causes the production of an antibody (q.v.).

Aromatics
These are hydrocarbon compounds containing as part of their structure rings of atoms such as are found in benzene and other similar cyclic molecules.
In petroleum products it distinguishes these hydrocarbons from those which are chainlike in structure (paraffins). Aromatics tend to have higher octane ratings (q.v.).

Arrestment/Arrester
Arrestment of a pollutant from a gas stream is the process of its trapping or removal by an arrester or cleaning device.

Asbestos
Natural material of a fibrous nature with a number of uses, eg building materials, brake shoes, depending on its resistance to high temperatures and its thermal insulation properties. Long term exposure to airborne asbestos dust can lead to asbestosis, a lung disease.

Ash
The nonvolatile inorganic residue left when a fuel is burned completely.

Atmosphere
The atmosphere is the envelope of air around the earth.
An atmosphere may refer to a much more local volume of air without implying the quality of that air. It may also be found as an obsolescent unit of pressure.

Atomic Power
By this or nuclear power is normally meant electricity generated in a power plant for which the source of heat is nuclear fission.

Atomisation
The process by which a solid or liquid is reduced not to atoms but to very small particles or droplets as in a fine spray. Good atomisation of fuel oil, allowing increased fuel/air mixing, is necessary to obtain satisfactory combustion. Atomised pollutants may persist suspended in air because of their small particle size.

Authorised Fuel
In the United Kingdom the regulations consequent upon the Clean Air Act 1956 specify performance characteristics for fuels (mainly smoke production) on the basis of which they may be authorised for use in smoke controlled areas.

Bacharach Smoke Scale
A scale of 10 shades from white to black for the assessment of smoke in flues. A smoke stain obtained by sampling flue gases through a filter paper in a prescribed manner is graded according to the scale.

Background
If a local atmosphere is polluted by some substance from a particular local source then the background level of pollution by that substance is the concentration of that substance there would be in that air without that local source of pollution.
Sometimes the word is used to mean the concentration of the substance some distance from the particular source and therefore largely uninfluenced by it.

Bar
The SI unit of pressure equal to 10^5 Newtons/m^2 or 10^6 dynes/cm^2.

Beaufort Scale
A scale for estimating and reporting wind force ranging from 0 for calm to 12 for a hurricane.

Benefit/Cost
The Benefit/Cost ratio seeks to compare the benefits of a particular action with its cost. In the case of antipollution expenditure the benefits have to be assessed of the effect of reduced pollution. A benefit/cost ratio of 10:1 implies that for every £1 spent on improving the pollution situation, the benefits can be valued at £10.

Beryllium (Be)
A light metal used in several industries, eg nuclear power, and products, eg fluorescent light tubes. It is highly toxic. Air pollution by beryllium-containing dust has been known to occur at or near points of production and use and in the disposal of products.

Best Practicable Means
See Means.

Bituminous Coal
The most general form of British coal, it produces a relatively high proportion of volatile hydrocarbons (over 13%) and, burned in the traditional domestic grate, it will give rise to smoke.

Boundary Layer
Where a fluid flows past a physical boundary, the boundary layer is that part of the fluid extending from the boundary into the bulk of the fluid in which the motion of the fluid is much affected by the frictional drag at the boundary.
The earth's atmospheric boundary layer is typically the lowest 1000m or so of the atmosphere.

Bronchitis
Basically bronchitis is inflammation of the bronchi, the two branches of the air pipe leading to the lungs. It is a reaction of the mucosal lining to an irritant. The word is less exactly, but more widely, used to describe a variety of lung disablements which can be associated with air pollution—particularly smoking.

B.S.I.
British Standards Institution. The national standards setting body in Britain. Among the things it specifies are products and methods of test or measurement.

Btu
British Thermal Unit. A unit of energy approximately equal to 1055 Joules or 0,252 kilocalories. It is the amount of heat required to raise the temperature of 1 lb of water by 1 Fahrenheit Degree (60–61°F).

Buffer Capacity
The capacity of certain solutions to oppose a change in properties eg particularly acidity when acid or alkali is added.

Buoyancy
The tendency of material immersed in a fluid to float up. In air pollution it is frequently applied to the tendency or otherwise of the hot gases emitted from a chimney to rise in view of their lower density relative to that of the surrounding air.

Cadmium (Cd)
A metal having toxic compounds. It occurs in minerals used for zinc production and is thus a potential air pollutant around zinc smelters. As with lead, human intake of cadmium can be from food and drink as well as the air.

Calm
The air is described as calm in meteorological terms if the wind speed is less than 1 knot or 0,2 m/s.

Calorific Value
A measure of the heating quality of fuels, usually expressed as available heat units, from the complete combustion of unit mass of fuel, eg Btu/lb, kJ/kg or MJ/kg for solid or liquid fuels and Btu/ft^3 or MJ/m^3 for gaseous fuels. There are gross and net calorific values for hydrogen-containing fuels depending respectively on whether the heat of condensation of water produced is included or excluded.

Carbon Dioxide (CO_2)
This is the gas which is formed by complete combustion of the carbon in any fuel. It also arises from natural sources, and is removed from the atmosphere by plants and by solution in water, mainly in the sea. An excess of carbon dioxide can be suffocating in confined circumstances but it is rarely found in hazardous concentrations in the open air.

Carbon Monoxide (CO)
This colourless odourless gas is produced by the incomplete combustion of carbon in any fuel. It also arises from natural sources. It is toxic at sufficient concentrations. Generally it is present only at low concentrations in the atmosphere. A major man-made source is the petrol engine which can give rise to raised concentrations in busy streets. Smokers expose themselves to higher concentrations.

Carburation
The mixing of air with a volatile fuel to provide the combustible mixture for use in the internal combustion engine. The device in which this occurs is the carburettor.

Cascade Impactor
An instrument to sample particulates and separate them into a number of successive fractions in different size ranges.

Catalyst—catalytic combustion
A substance which, though not itself permanently changed, alters the rate of (usually speeds up) a chemical reaction. Catalysts are often used to speed up combustion or allow combustion to occur at a lower than usual temperature.

CEC
Commission of the European Communities. The civil service of the EEC (q.v.), it is assigned the task of preparing regulations and directives etc.

Celsius
The SI name for the temperature scale in which the freezing point of water is 0° and the boiling point of water is 100°. Previously called the Centigrade scale.

Cenosphere
Small hollow spherical particles arising from the incomplete combustion of liquid and solid fuel droplets or particles.

Centrifugal
The adjective describing the outward force on an object circling a point eg if one whirls a ball on a string, the tension on the string is related to the centrifugal force on the ball.

Cetane No.
A rating of the ignition quality of diesel fuel, eg readiness to initiate combustion upon injection into the hot compressed air; originally the percentage of cetane in a mixture of cetane and 1-methylnaphthalene having the same ignition quality as the fuel under test. Cf octane rating.

Chromatography
A method of separation of mixtures, and hence analysis, based on selective adsorption. Particularly used to separate organic compounds.

Chronic
Referring to damage or effects of air pollution, particularly to health, it implies lasting or long term damage as against acute effects (q.v.).

Chrysotile
A fibrous mineral commonly a component of commercial asbestos (q.v.).

CGS
Centimetre-Gramme-Second—a system of units being superceded by the SI system (q.v.).

Classification
Separation of items into types. In relation to particles it implies the process of separating them into fractions of defined size range.

Clinker
Aggregated or sintered ash formed when the ash is heated strongly in a furnace.

Coal Equivalent
A method of describing the combustion energy of a given weight of fuel in terms of the weight of a standard coal which would produce an equal amount of heat energy.

Coalite
A trade name for a semi-coke smokeless fuel produced by low temperature carbonisation of coal.

COH
Coefficient of haze. This is an American unit for measuring smoke stains (q.v.) which depends on the reduction of light transmission through the filter after it has collected the smoke sample. Its object is to measure haze over a distance of 1000 feet.

Cohort
A group banded together. In medical studies a group of people with certain similar characteristics, age or environment, which makes them particularly suitable for study of some variable.

Coke
A smokeless solid fuel traditionally formed from coal by destructive distillation. It may also be produced from oil.

Cold Front
The sharp boundary between two extensive air masses where cold air is replacing warm air.

Combustion
The chemical combination of oxygen with fuel (combustible matter) with rapid heat evolution so that the temperature rises.

The products of combustion are the oxidation products of the components of the fuel. Thus hydrocarbons produce carbon monoxide, carbon dioxide and hydrogen oxide (water). Combustion of the sulphur in fuels produces sulphur dioxide.

Concentration—see also ground level
The amount of a substance in a given volume. The most general form for air pollution is $\mu g/m^3$ ie micrograms or millionths of a gram contained in a cubic metre of air.

For gaseous pollutants a common alternative is p.p.m.; the number of parts by volume of the pollutants in one million parts of the total gas.

Confidence Limit
A statistical expression. Confidence limits of x per cent mean that there is an x per cent chance of the value of a variable falling between the limits so defined.

Contaminant/Contamination
Common synonyms for pollutant/pollution indicating the presence of a foreign component.

Continuous Sampling
Uninterrupted sampling of air, usually at a fixed rate. Where the sample can be analysed continuously, the stream of gas may be passed through the measuring instrument continuously. Otherwise the sample is collected in an uninterrupted fashion for a given period and the total sample is finally analysed to give the mean composition of the air over the whole period.

Convection
The transfer of heat in a fluid by flow of parts of the fluid at different temperatures. Convection currents can be set up in air with the rise of hotter, less dense parts and the downward flow of cooler, more dense parts.

Correlation
A mathematical term describing the relationship of one variable factor to another.
A correlation coefficient is a measure of the degree of association between corresponding values of two variables. A value of zero indicates the absence of correlation. Values between zero and 1 (positive or negative) indicate the degree of correlation (direct or inverse).

Cost/Benefit
See Benefit/Cost.

Cracking
The refinery process of chemically breaking up the heavier petroleum distillates to obtain greater quantities of lighter products.

Critical Temperature and Pressure
The critical temperature of a given gas is the temperature above which it cannot be liquified. The pressure at which the gas may just be liquified at its critical temperature is its critical pressure.

Criteria (Air Quality)
Information used as guidelines for establishing air quality standards or goals. Often in the form of dose/response relationships.

Crocidolite
An asbestos mineral—see Asbestos.

Crude Oil
The raw mineral hydrocarbon oil obtained from oil wells. For commercial use it is refined and distilled into various fractions and products.

Cryptic
Literally hidden. In referring to pollution damage it implies damage without visible signs eg reduced growth in plants.

Cubic Metre (m^3)
See Metre.

Cumulative (Sampling & Effect)
Sampling—a system in which the sample is accumulated over time either by being taken continuously or for periods at regular intervals to give a single sample whose composition is regarded as representative of the whole period of its accumulation.
Effect—increasing or building up with successive or continuing exposures.

Cupola
A firebrick-lined shaft furnace used in melting metals, often pig iron (with or without scrap) for castings. Metal, coke and flux (if used) are charged at the top and air is blown in near the bottom. Its operation involves the emission of iron oxide fume which has to be arrested.

Cycle (Driving)
See Driving Cycle.

Cyclone—device & atmospheric condition
1) A mechanical device for the removal of particles from gas streams by centrifugal force imparted by a whirling motion of the gas inside the device.
2) A natural wind system rotating around a centre of low barometric pressure.

Decay
In air pollution the decay of an airborne pollutant usually implies the rate at which it is lost from the atmosphere, eg by absorption or precipitation, including its loss by transformation into some other chemical.

Degree Day
The condition of a mean of one degree difference in temperature between the outside temperature and a given base temperature (the figure usually adopted in Britain is 60°F (15·6°C) over one day of 24 hours is termed "one degree day". The heating requirements (ie fuel consumption) of a building over a period are often taken to be proportional to the number of degree days, ie the sum of the degree day values for the days of the period.

Density
Basically the mass of a unit of volume of a material, eg grams per cubic centimetre or pounds per cubic foot.

Deposit Gauge
An instrument designed to assess the rate of deposition of material from the air. In most instances the gauge receives material through a horizontal opening and the results can be expressed in terms of amount deposited on a given area in a given time. There are two BSI Specifications for deposit gauges, BS 1747:Parts 1 & 5.

Desorption
The removal of absorbed or adsorbed material.

Desulphurisation
Literally the removal of sulphur. To reduce sulphur dioxide emissions it is possible to use *fuel desulphurisation* so as to reduce the sulphur present in the fuel when it is burned, or *flue gas desulphurisation* in which the sulphur dioxide is removed from the gases formed by combustion.

Determination
In analysis a determination is a measurement of the amount of something.

Dew Point
The temperature to which a particular sample of air has to be cooled before it starts depositing dew. It is a measure of the air's moisture content, the higher the moisture content the higher the dew point.

Diesel
The Diesel engine is a type of internal combustion engine in which air is heated by compression so that combustion occurs when the fuel is injected. It thus employs compression ignition as against spark ignition which is the principle of the petrol engine. The type of petroleum distillate used by the diesel engine is referred to as diesel oil or derv.

Diffusion
On the scale of molecules, diffusion is a mixing of substances caused by molecular motion. In meteorology it implies the apparently random exchange of small bodies of gas between adjacent regions in the atmosphere.

Disperson
In the sense in which it is used in air pollution matters, dispersion describes the way in which a pollutant spreads from its points of emission and becomes diluted in the atmosphere.

Disposal
In relation to wastes it is the final act or system of getting rid of a waste.

Dissociation
The splitting of molecules into simpler molecules, atoms or groups of atoms or ions.

Distillate
Fundamentally the distillate is any product obtained by vaporisation from a still or distillation apparatus. The term distillate fuel is often applied to a fraction heavier than petrol or to paraffin (kerosine) or to gas oil.

Diurnal
An adjective describing the variations in some parameter during a typical day.

Dolomite
A magnesium calcium carbonate mineral akin to limestone. It has been used because of its alkalinity for the removal of sulphur oxides from flue gases.

Dose
The amount taken or received. In the assessment of pollution effects an important factor is the dose/response relationship for any exposed individual or organism.

Downwash (Downdraught)
A downward air current (downdraught) to the lee of a chimney or building may cause the descent (downwash) of smoke or other emissions below the level of their emission.

Driving Cycle
In relation to the testing of motor vehicles, particularly to estimate their pollution emission characteristics, they may be made to perform standard driving cycles which are fixed patterns of steady speeds, accelerations and decelerations typical of some particular form of driving, eg urban use.

Dust
According to the British Standard BS.3405 dust is defined as small solid particles in the size range 1 to 75 um in diameter. Above this size the particles would come into the category of grit. Below about 1 μm the particles, if airborne, would tend to remain in suspension rather than settle out under their own weight.

Dustfall
The rate at which dust is deposited from the air.

ECE
The Economic Commission for Europe. A body for region-wide economic co-operation within the framework of the United Nations. Its membership consists of all the European members of the United Nations together with the United States of America. It proposes various standards such as emission standards for motor vehicles.

Ecology
The relation or interacting of living systems with each other and their surroundings.

Eddy
A fluctuation of the motion of a fluid, usually superimposed on the mean flow of the fluid (see also Turbulence).

EEC
The European Economic Community—the Common Market whose members are Belgium, Denmark, Eire, Federal Germany, France, Holland, Italy, Luxembourg and the United Kingdom.

Effluent
Literally anything which flows out or is discharged. Usually applied to the discharge of a waste material into a stream, sewer or to the air.

Efflux Velocity
The speed with which something is emitted from an orifice, eg gases from the top of a chimney.

Effective Chimney or Stack Height
The effective height of a chimney is the sum of its actual physical height and the rise of the emitted plume caused by its buoyancy (q.v.) and efflux velocity (q.v.).

Electrostatic
Generally describing something having an electrical charge. An elextrostatic precipitator is a system for removing particles from a gas by giving them an electrical charge and then getting them to adhere to a plate having an opposite electrical charge.

Elutriation
A process for separating fine particles into sized fractions by their rate of gravitation in a rising stream of fluid.

Emission
The material being discharged into the atmosphere. An emission is often expressed as an emission rate eg mass/unit time or an emission concentration eg volume or mass of material per unit volume of total emitted gas.

Emission Standard
The amount of pollutants permitted to be discharged from a pollution source. Emission standards are commonly described in one or more of the following ways:
a) weight of pollutants over a certain time eg lb/hr, kg/hr or tons/day;
b) weight of pollutants per weight of material processed eg 40 pounds per ton (~2%);
c) weight of pollutant per unit volume of discharged gas eg grains/ft^3 or mg/m^3.
d) the volume of pollutants (if gaseous) per unit volume of discharged gas eg parts per million.

Emphysema
Pulmonary or lung emphysema is an over-distension or swelling of the lung air spaces owing to destruction of the alveoli which diminishes the area for exchanging oxygen and carbon dioxide between the air and the blood.

Environment
Literally surroundings; can apply to the indoor or working conditions but commonly refers to man's total surroundings, natural and manmade.

Epidermis
The outermost layer of skin of animals and some vegetable matter, eg leaves.

Epidemiology
The scientific study of the frequency and distribution of a disease within a population and often extended to include the relationship with external factors such as air pollution.

Equivalent Diameter
This has several technical meanings. In relation to airborne particles it is used to describe the way in which a particle behaves namely as if it were a sphere of a certain diameter (and often of a standard density).

Error (Sampling/Analytical/Random)
Colloquially an error is a mistake. In several scientific fields it is used to denote the difference between a measured value of something and its true value.
Sampling error represents the deviation of the properties (eg composition) of a sample from those of the whole.
Analytical error represents the deviation of the analytical result from the true composition of the thing being analysed.
Random error is where the measured values are likely to be distributed in an unbiased fashion above and below the true value.

Exposure
A measure or description of the extent to which an object or organism has been subjected or exposed to a particular pollutant.

Extrapolate
To estimate the value of something beyond the range in which it has been measured, eg estimating pollution levels in the near future from a number of values over past years. Cf. interpolate.

Filter
A medium for separating solids or liquid particles from fluids or solid particles from other particles of different size depending on the type of filter used.

Flame Ionisation
Certain gaseous compounds, notably those containing carbon, can be estimated by the extent to which they are

ionised in a hydrogen flame. The technique is called flame ionisation detection. (F.I.D.).

Flashpoint—open and closed
The lowest temperature at which a liquid fuel will give off a flammable vapour which will burn momentarily. There are several methods of measuring the flashpoint eg using an open or closed cup for the test.

Fluidised Bed
A chemical engineering term to describe a bed of solid particles through which air or some other gas is blown upwards in such a fashion as to support the particles and make them act in many ways like a liquid. Furnaces have been devised in which oil or powdered or granulated coal can be introduced into such a (heated) bed where it will burn evenly and produce an even temperature throughout the bed.

Fluorine/Fluorides (F)
In air pollution fluorine is often used to cover both the element of that name and its compounds, mostly fluorides. Fluorine and its soluble compounds can be highly toxic. It is a pollutant particularly associated with brick and aluminium production.

Fly Ash
The finely divided particles of ash readily entrained in flue gases arising from the combustion of fossil fuels (mainly coal). The particles of ash may contain partly burned fuel.

Fog
Atmospheric obscuration caused by liquid water droplets. In meteorological terms a fog imples a visibility of less than 1 km. (cf. haze).

Fossil Fuels
A general term covering coal, oil, natural gas etc which are fuels derived from organic deposits in past geological periods. They consist mainly of carbon and hydrocarbons. By comparison wood and nuclear fuel are not fossil fuels.

Freons
A range of hydrocarbons with hydrogen replaced, partly or totally, by fluorine or chlorine. These wholly man-made compounds are used as refrigerants, in fire extinguishers and as aerosol propellants. They are thus being found widely at very low concentrations in air where they have a long life.

Frequency Distribution
A graphical way of showing the frequency of occurrence of values of some parameter against the values of that parameter.

Fume
Very fine solid or liquid particles 0·001 to 1 μm in diameter arising from chemical reactions or condensation of vapour (often metal vapour).
The word fumes is commonly used to imply unpleasant and smelly airborne effluents.

Fumigation
When pollution from an emitter has been trapped under an inversion layer, it is sometimes brought rapidly to ground level with minimum dilution by turbulence as the inversion breaks up. This is called fumigation.

Gas Oil
A liquid petroleum distillate having a viscosity and distillation range between paraffin (kerosine) and light lubricating oil. It is in the same boiling point range as diesel oil. Often used for heating purposes, it has a relatively low sulphur content.

Grab—sample
A sample taken or grabbed at a single point in time rather than accumulated over a period and thus it is representative only of the conditions at the particular time of sampling. Snap sample has a similar meaning.

Grain
The word has a number of meanings in common use. In air pollution work it is often encountered as a unit of weight. This old apothecaries' unit is still used in certain regulations in describing permissible concentrations (grains/ft^3) of pollutants in process emissions.
1 grain is approximately 0·0648g.
1 grain/ft^3 is approximately 2·3g/m^3.

Gram (g)
The gram is the metric unit of mass. One thousand grams, a kilogram (kg) is the basic SI unit of mass. A milligram (mg) is a thousandth of a gram. Air pollution levels are often expressed in millionths of a gram (microgram or μg) per cubic metre (q.v.).

Greenhouse Effect
The name given to the retention of heat by the earth and the atmosphere owing to carbon dioxide in the air being "transparent" to incoming short-wave solar radiation but "opaque" to longer wave radiation back from the earth in the same way that glass causes heat retention in a greenhouse.

Grit & Dust
The particles of solid in the air or flue gases which fall out or deposit under their own weight comprising dust (q.v.) and grit, which implies larger particles which fall out very rapidly. The British Standard BS.3405 categorises particles of diameter greater than 75 μm as grit.

Ground Level Concentration
The concentration (amount per unit volume) of a pollutant in air between ground and about 2 metres above the ground i.e. at breathing level. Where concentrations do not vary much with height it may be more convenient to make measurements at a height greater than 2 metres.
Sometimes abbreviated to g.l.c. which is also used for gas liquid chromatography.

Guideline—air quality
Air quality guidelines indicate levels and durations of air pollution by certain substances above which effects on materials, vegetation or health are produced. They are thus guides to desirable air quality.

Haze
A state of the atmosphere in which visibility is restricted, owing to the presence of very small dry suspended particulates which make one describe the air as hazy.

Heavy Metal
A term loosely used to describe not only such dense metals as lead but a whole range of elements, not all of them metals, which may, as suspended and deposited particulates, contaminate our environment eg lead, cadmium, chromium, nickel, cobalt, iron, vanadium, germanium, selenium, molybdenum, manganese, arsenic, zinc, beryllium. Since it is their toxicity which is often of concern, they are sometimes described collectively as toxic metals.

Histogram
A form of diagram showing the frequency of occurrence of values of a variable in various ranges. Columns or rectangles proportional to the frequencies of occurrence are set on a scale showing the ranges.

Humidity/Relative Humidity
The moistness or water vapour content of the atmosphere is its humidity.
Relative humidity is the moistness of the air as a percentage of the moistness of air when it is saturated with water vapour at the same temperature.

Hydrocarbon
Hydrocarbons are chemical compounds made up of only hydrogen and carbon. They are classified into a number of types according to their internal structures or ratio of carbon atoms to hydrogen atoms.
Hydrocarbons are the basic compounds in fossil fuels.

Hydrogenation
The process of adding hydrogen chemically to a substance. This is nowadays a major part of the process of refining crude oil.

Hydrogen Sulphide (H_2S)
A gas with the characteristic smell of rotten eggs. It is highly poisonous at all but the lowest concentrations. It is formed naturally, eg by volcanoes, but is also the product of various industrial processes whose emissions are controlled under the Alkali Act.

Hygrometer
An instrument for measuring the humidity of the air.

IEC
International Electrotechnical Commission.

Immission
Strictly this means intake by a receptor of pollution. Since this is often related to the concentration of the pollutant in the air there has been a tendency to speak of the immission concentration or even immission as the same as ground level concentration.
The word is a nuisance particularly since it is difficult to distinguish in normal speech from emission.

Ingestion
The taking in of substances to the stomach.

Instantaneous—sampling—analysis—peak
Instantaneous sampling implies sampling at one point in time rather like grab sampling (q.v.).
Instantaneous analysis usually refers to a pollution measuring system in which the analysis is so quick that the results represent the current situation. An instantaneous peak refers to a short term high value, eg of a pollutant concentration.

Internal Combustion Engine
An engine in which a fuel/air mixture is burned within a chamber and the resulting pressure of hot gas is converted to mechanical energy. In contrast external combustion, as in a boiler furnace, involves the transmission of energy by a separate agent, eg via a steam cycle.

Intermittent—sampling
In contrast to continuous sampling (q.v.) intermittent sampling means that sampling occurs at intervals for only a fraction of the total time.

Interpolate
To estimate the value of something between actual measured values, eg estimating pollution levels at points between sites at which pollution measurements are actually made.

Inversion
In meteorology an inversion exists where the normal temperature gradient in the atmosphere (decreasing temperature with height) is inverted at some height. In the space below this, pollutant emissions may be trapped and accumulate.

In Vitro/In Vivo
These two terms differentiate the experimental reproduction of biological processes in isolation from the living organism—in vitro—and biological processes occurring within the living organism—in vivo.

Ion
An electrically charged atom, radical or molecule.

Isokinetic
Literally equal moving. Isokinetic sampling implies sampling at such a rate that the motion of the gas entering the sampling nozzle is the same as that of the gas being sampled. The sample can thus be expected to have the same particulate content as the gas being sampled.

Isopleth
A line drawn on a map linking places with the same value of some parameter, eg height, annual rainfall, pollutant concentration etc; a sort of contour line.

Isothermal
Literally at constant temperature. An isothermal layer in the atmosphere is one in which there is not temperature variation with height above the ground.

ISO
International Standards Organisation.

Isotope
Many elements exist in a number of forms of different atomic weight: isotopes. While they have similar chemical properties their physical properties differ. The most dramatic type of possible physical difference is probably radioactivity.

Joule (J)
The SI unit of energy, the capacity for doing work. 1 Joule$=10^7$ ergs. There are several different common forms of energy, eg thermal, electrical, chemical etc. 1 calorie (cal)$=4{\cdot}1868$ J and 1 Btu is approximately 1055 J.

Katabatic Wind
The local flow downhill of cold air, usually occurring on clear nights.

Kelvin (K)
The SI unit of temperature interval. The Kelvin or absolute scale of temperature starts from absolute zero temperature.
1 Kelvin degree$=$1 Celsius degree$=1{\cdot}8$ Fahrenheit degree.
$273{\cdot}15°K=0°C=32°F$

Kerosine
A liquid petroleum distillate (paraffin) used for lamps and heating appliances. Kerosine is also used in industrial gas turbines and jet engines.

Kilogram (kg)
The SI unit of mass. 1 lb is approximately 0·4536 kg.

Knock
The situation in a spark ignition internal combustion engine where part of the air/fuel mixture detonates on compression before the flame front has reached it. The tendency of a fuel to knock in a petrol engine can be reduced by the blending of suitable components in the fuel or by antiknock additives (q.v.).

Labile
A labile material is one which is unstable or reactive.

Lachrymatory (Lacrimatory or Lacrymatory)
Causing tears. Certain substances cause tear production when they come in contact with the eyes, eg PAN (q.v.).

Land Breeze
See Sea Breeze.

Lapse Rate
In meteorology, this term is used to denote the rate of decrease of a quantity with height. Temperature is usually implied. Usually temperature decreases with height, ie there is a lapse rate. One speaks of a negative lapse rate if temperature increases with height.

Laser
A system of producing a very narrow light beam (monochromatic and in-phase) which does not diverge and can be transmitted long distances and aimed accurately. Laser radar or LIDAR (q.v.) is used in air pollution studies.

Lead (Pb)
A metallic element. Lead and its compounds can be retained in the human body with clinical and sub-clinical effects. In contrast to other air pollutants lead is one where the bulk of human intake comes not from the air but from food and drink. Lead in the air arises most generally from antiknock additives to petrol. Lead industries can contribute to local aerial and land contamination.

Lead Dioxide Candle
A device in which sulphur dioxide in the air reacts with a film of lead dioxide to produce lead sulphate which is subsequently measured. The device thus

gives an indication of sulphur dioxide in the air but its performance is influenced by conditions such as wind and humidity.
There is a British Standard instrument, BS 1747: Part 4, which is obsolescent.

Lean—mixture
The air/fuel mixture is an internal combustion engine is described as lean if it contains a low proportion of fuel. At the other end of the scale a mixture with a high proportion of fuel is described as rich.

LIDAR
Laser-radar which can be used to study the position and concentration of pollutants both particulate and gaseous by the reflection or absorption of a laser beam.

LNG
Liquefied Natural Gas.

LPG
Liquefied Petroleum Gas.

Lung Function
Literally the function of the lungs namely the transfer of oxygen from the air to the blood and the disposal to the air of carbon dioxide from the blood. More specifically it is a measure of long performance.

MAC
Maximum allowable concentration. An American term akin to the TLV (q.v.).

Mean—algebraic—arithmetic—geometric
Generally similar to the idea of an average. The arithmetic mean, or the average, of a set of values is their sum divided by their number. The algebraic mean takes account of whether the numbers are positive or negative. The geometric mean is the nth root of the product of n values.

Means—best practicable
According to the Alkali Act a scheduled process must be provided with the *best practicable means* for preventing the escape of noxious or offensive gases and smoke, grit and dust to the atmosphere and for rendering such gases, where necessarily discharged, harmless and inoffensive. The worlds best practicable means are often used to describe the whole approach of British anti-pollution legislation towards industrial emissions which takes account of the cost of pollution abatement and its effect on the viability of industry.

Median
The middle value in terms of magnitude in a series of values. If the number of values is even then the median is the mean of the two middle values.

Mercaptan
Organic compounds with the general formula R-S-H.

Mercury (Hg)
A dense metallic element, liquid at normal temperatures. It is for instance used in thermometers. It has wide industrial uses. The metal in vapour form and its compounds are extremely poisonous but normal ambient concentrations are not regarded as harmful.

Meteorological
This is the adjective derived from meteorology which is the study of the physical phenomenon of the earth's atmosphere in relation to weather and climate.

Meter
Sometimes an alternative spelling for metre (q.v.).
Usually a machine or instrument for measuring something eg a gas meter.

Metre (m)
This is the basic international (SI) unit of length and from it are derived the units of area, the square metre (m^2) and of volume the cubic metre (m^3). $1m = 39{\cdot}37$ inches. $1m^2$ is approximately $10{\cdot}76$ ft^2 and $1m^3$ is approximately $35{\cdot}31$ ft^3.

Microclimate
The distinctive pattern of meteorological variables within the lowest layers of the atmosphere or (sometimes) within a limited area (eg a town).

Microgram (μg)
A microgram is a millionth (10^{-6}) of a gram (q.v.) and is a unit of mass.

Micrometeorology
Detailed study of physical phenomena in the very lowest layers of the atmosphere or occasionally over a restricted area (eg a town).

Micrometre (μm)
This is a unit of length, one millionth (10^{-6}) of a metre. It is still commonly referred to as a micron.

Millibar (mbar)
A unit of pressure, one thousandth of the basic SI unit, the bar (q.v.). The millibar is equal to 100 Newtons/m^2 or 10^3 dynes/cm^2 and approximately 0·75mm of mercury.

Mist
A suspension or dispersion of liquid droplets in a gas. Usually applied to water droplets in air where visibility has a value of 1 km or more. Natural mists may be aggravated by air pollutants. See Haze and Fog.

Mixing Height
The height in the atmosphere within which emitted pollutants are dispersed and mixed. Often the height of the bottom of an inversion layer (q.v.).

Model (Mathematical/Physical)
1) An air pollution mathematical model is a numerical simulation of the emission, dispersion and chemical processes controlling ambient pollutant concentrations.
2) A physical simulation (eg in a wind tunnel) of the emission and dispersion processes controlling ambient pollutant concentrations in a physical model.

Mole
The amount of a substance of a certain formula that contains the same number of formula units (atoms or molecules etc) as 12g. of carbon of atomic weight 12. It is thus the formula weight in grams and used to be called the gram molecule.

Monitoring
Generally this is used interchangeably with surveillance (q.v.) to mean measuring air pollution continuously or regularly. More specifically it may imply checking that the level of an air pollutant is within prescribed limits.

Nanogram (ng)
A unit of mass equal to one thousandth of one millionth of a gram (10^{-9}g).

Natural Gas
In contrast to coal gas or town's gas which are manufactured by distillation or chemical reaction, natural gas comes from the tapping of natural hydrocarbon deposits. It does not contain carbon monoxide.

Necrosis
Fatal damage to cell tissue.

Nephelometer
An instrument for measuring the amount of light scattered or absorbed by a suspension of particles. It is used to determine suspended particle concentrations or particle size.

Neutral—solution—atmosphere
Neither one side nor the other, indeterminate. Thus a neutral solution is neither acid nor alkaline.
A neutral atmosphere is one in which there is no change in potential temperature with height.

Newton (N)
The SI unit of force. A force of 1 Newton applied to a mass of 1 kg will produce an acceleration of 1 metre per second per second. It is equal to 105 dynes or approximately 0·223 lb force or 0·102 kg force.

Nitric Acid (HNO_3)
A fuming unstable acid liquid. It is used industrially in the production of fertilisers, explosives etc. It can be formed as an aerosol in the atmosphere by the oxidation of oxides of nitrogen plus water.

Nitric Oxide (NO)
A colourless gas, toxic at sufficiently high concentrations. High temperature combustion tends to fix or combine atmospheric nitrogen as nitric oxide. It is involved in the photochemical reactions with certain hydrocarbons producing oxidants.

Nitrogen Dioxide (NO_2)
A stable brown gas, toxic in sufficiently high concentrations. It is formed by the aerial oxidation of nitric oxide (q.v.).

Nomogram
A form of chart containing scales for the variables (usually 3) involved in a particular formula or calculation. For any values of two of the variables the corresponding value of the third lies in a straight line with the values of the other two.

NOX
This is a shorthand way of referring to all the oxides of nitrogen, but usually to nitric oxide (NO) and nitrogen dioxide (NO_2) in matters of air pollution. Nitrous oxide (N_2O), the anaesthetic laughing gas, is a third reasonably stable oxide of nitrogen.

Noxious
Harmful.

N.T.P.
Normal Temperature and Pressure.
A temperature of 0°C and a pressure of 760mm mercury. Information on gas volumes etc can often be more easily compared when expressed at these 'standard' conditions of temperature and pressure.

Nuclear Power
See Atomic Power.

Obscuration
Concealing from sight. In meteorology it relates to restriction of visibility.

Octane Rating
An indicator of the tendency of a motor gasoline to knock (q.v.) in a spark ignition internal combustion engine, higher octane ratings being required for engines of higher compression ratios. The octane number is the percentage by volume of the hydrocarbon iso-octane in a mixture with normal heptane which has the same knocking characteristics as the fuel under test. The higher the octane number the lower the tendency to knock.

Odour Threshold
The concentration of an odour-bearing gas at which only half of a panel of sniffers can detect the smell.

Olefins
Hydrocarbons of the ethylene series of the general formula C_nH_{2n}. They have a double bond between two carbon atoms which makes them very reactive. It is reactive hydrocarbons of this sort which take part in photochemical smog reactions.

On-line
1) A method of measuring a variable in a process continuously and rapidly as the process operates is described as on-line.
2) The arrangement of a computer to process input data without delay and present an output result, say to control a plant, is described as on-line operation.

Organoleptic
Affecting a sensory organ. Thus organoleptic methods of estimating odour depend upon their perception by the human nose.

Orographic Rain
Rain caused by the rising and cooling of moist air as it passes over mountains.

Oxidants
Materials which have an oxidising action on other materials i.e. generally adding oxygen to them chemically or extracting hydrogen.
Typical atmospheric oxidants are ozone and nitrogen dioxide whose action on vegetable material can be damaging.

Oxides of Nitrogen
See NOX.

Oxygen (O)
The normal molecular form of oxygen (O_2) is the most essential constituent of the air for all life. 21% by volume of the air at ground level consists of oxygen. Oxygen is consumed when all fuels are burned.

Ozone (O_3)
This is a reactive molecular form of oxygen (q.v.) which is harmful in sufficient concentrations, particularly to plants. The atmosphere has a natural ozone gas content but further quantities arise from the photochemical reactions of hydrocarbons and oxides of nitrogen produced particularly by combustion.

PAN
Peroxyacetyl nitrate. This is the eye-irritant compound associated with the Los Angeles type photochemical smog.

Particle Size Distribution
A way of expressing the make up of a population of particles in terms of either the weight or number of particles between certain size limits, eg diameters of 0-1 μm, 1-5 μm, 5-10 μm etc. There are instruments for separating particles into these fractions.

Particulates
Particulate matter in the air usually refers to small solid particles of material found in the atmosphere in addition to gases. Less frequently applied to small liquid aerosol particles.

Pathogenic
Capable of producing disease.

Petri Dish
A shallow circular glass, or plastic, dish used for bacterial cultures.

pH
A unit by which the acidity or alkalinity of a liquid is described. Water, which is described as neutral, has a pH of 7. A lower pH signifies greater acidity than water and a higher pH greater alkalinity. pH is in fact the negative logarithm of the hydrogen activity (usually similar to concentration).

Photochemistry/Photochemical
Photochemistry deals with the chemical effects of radiation, chiefly visible and ultra-violet, and also the production of radiation by chemical changes.
Sunlight can produce chemical reactions between certain atmospheric pollutants, notably oxides of nitrogen and reactive hydrocarbons. These reactions are involved in the formation of photochemical smog.

Phytotoxic
Poisonous to plants.

Plume
The flow of effluent (usually visible effluent) from a specific outlet such as a chimney stack or vent.

Pneumoconiosis or Pneumonoconiosis
A term applied to various diseases of the lung caused by the inhalation of dust particles in such occupations as coal mining, quarrying and asbestos working; an excess of fibrous tissue forms in the lungs round the dust particles.

Pollen
The small grains from the anthers of flowers which contain the male reproductive nuclei. Transported in the air certain of these grains in the air can induce hay fever or asthma in some people by action in the nose. They are thus natural air pollutants.

Pollutant (Primary & Secondary)
A pollutant is something which pollutes the air (see pollution). A primary air pollutant is one which is put into the air in that form. A secondary pollutant is not emitted as such but forms in the air from primary materials.

Pollution
There are many different views as to what constitutes pollution. To some, pollution implies the increase, or even decrease, of any environmental constituent from the value it would have without human activity. A more useful definition is that pollution is significant if an environmental constituent is present to the extent that there is a significant hazard to present or future health or to the natural systems upon which man depends. Pollution may also be significant if it has a serious effect upon amenity (q.v.).

Polycyclics
Organic compounds with molecules containing a number of rings of carbon atoms. Certain polycyclic hydrocarbons which can arise from combustion are carcinogenic, ie capable of causing cancer. Sometimes polycyclics are called polynuclears.

ppb (European)
A billion in European usage is a million times a million (10^{12}) so ppb is parts per million million. Cf. ppb (U.S.).

ppb (US)
In America a billion is used to mean a thousand million as against a million million in Europe. Thus 1 ppb (US) = 1000 ppb (European).

pphm
Parts per hundred million.

ppm
Parts per million. In pollution of the air by a gaseous pollutant it refers to the number of parts by volume of the gaseous pollutant in one million parts of the total air. Concentrations of various gases expressed in ppm are proportional to their molecular concentrations.

Precipitation
1) The formation of a solid from solution.
2) A process of separation of particles from a fluid. In meteorological parlance, moisture falling on the earth's surface as rain, hail or snow or even dew.

Precision
The extent to which repeated measurements conform to themselves; in contrast to accuracy which is how close the measurements are to the true values.

Precursor
Something which goes before. Commonly applied to substances in the air which subsequently react or are transformed to produce new air pollutants, eg hydrocarbons are precursors of ozone and other compounds associated with photochemical smog.

Primary Air
The air supplied to a fuel in its early stages of combustion.

Quartile
If a ranked series of values is divided into four equal parts, eg twenty values into four sets of five in order of magnitude, each set is called a quartile. The upper quartile is that set below which lie three quarters of the ranked series of values; the lower quartile is that set above which lie three quarters of the ranked series of values.

Radiation Fog
With a clear sky and light wind there can be substantial cooling of the air during the evening and night. Where the air temperature falls below the dew point (q.v.) a radiation fog can be formed.

Radiosonde
A balloon-borne instrument which transmits measurements of pressure, temperature etc as it rises and moves with the wind.

Rainout
Cf. washout. The mechanism whereby small particles in the air are removed by being accumulated in raindrops as they form.

Random error/sampling
Random error see error.
Random sampling or selection can be used loosely to describe a sampling regime without a predetermined pattern, eg just any time. Proper random sampling involves the express selection of sampling units or times so that there is no bias towards selection of particular units or times and the sample is as likely as possible to be representative of the whole.

Reference Method
A reference method of analysis is one against which others are compared. Usually it is a method of high accuracy and precision (q.v.) and need not be so simple to perform as a routine method.

Reflectance
The reflectance of a surface is a measure of the extent to which the surface will reflect light or other radiation.
Reduction in the reflectance of filter paper as it is soiled by smoke is the basis of the UK smoke stain method of measuring atmospheric smoke concentrations.

Relative Humidity
See Humidity.

Recycling
In respect of wastes such as paper etc recycling implies the reuse of the material generally to make the same sort of product. In some cases reuse for another purpose is included in the term recycling in that it is assisting material conservation. Exhaust gases from motor vehicles may be recycled in the air input to reduce the overall production of air pollutants.

Reproducibility
The extent to which an experiment or measurement performed under the same conditions will give the same results.

Residual Oils
The oils which are left over as unvaporised liquid from normal crude oil distillation. They usually contain more sulphur than the lighter oils, are denser, more viscous and may produce significant amounts of ash on combustion.

Response
Reaction or effect of something to a stimulus or influence, eg the effect of a pollutant concentration upon a living organism.

Rich (mixture)
See Lean.

Ringelmann
The British Standard Ringelmann smoke chart (BS 2742) is for assessing the darkness of a plume of smoke by visual comparison with a numbered set of grids differing from each other in the width and spacing of black lines printed on a white background. Thus Ringelmann 1 is equivalent to 20% black
2 ,, ,, ,, 40% ,,
3 ,, ,, ,, 60% ,,
4 ,, ,, ,, 80% ,,
5 ,, ,, ,, 100% ,,

"Dark smoke" is smoke which is as dark or darker than Ringelmann 2 and "black smoke" is as dark or darker than Ringelmann 4.

Sampling
The action of taking or withdrawing a fraction of something usually for study as representative of the whole. Proper sampling is most important in air pollution work.

Sampling Error
See Error.

Saturation
The point where a substance is charged with the greatest possible amount of another substance or property. In air pollution work it is most frequently used in respect of air being saturated with moisture in which case that air put in contact with a plane water surface at that temperature will neither gain nor lose water vapour.

Scrubbing
An absorption operation in which gaseous or fine particulate pollutants are removed from a stream of air or gas by contact with a liquid—a spray or a bath or wetted packing in a tower.

Sea Breeze
A local wind blowing on shore when and because the land surface is warmer than the sea surface, eg on a sunny day. The situation may be reversed at night, producing an off-shore land breeze.

Sea Fret
A local name for fog produced in on-shore winds in certain conditions. It normally does not persist very far inland. Another name is "haar". Dispersion is poor in haars hence, if they occur in regions where pollution is emitted, high pollutant concentrations may result. The haar may be made more persistent by pollutants.

Secondary Air
Air introduced above or beyond the bed of burning fuel to promote the complete combustion of volatile material produced in the first stage of combustion (see also Primary Air).

Sensitivity
In chemical analysis the sensitivity of a method is a measure of the minimum increment of the item of interest which can be estimated by the method. It is also used to describe an abnormal reaction of the body to certain substances (see Allergy).

Settling Velocity
See Terminal Settling Velocity.

Shear
See Wind Shear.

Significance
A statistical term used in assessing whether the difference between an observation (result) and some standard of comparison is real and not attributable to observational error etc.

SI Units
Units of measurement in the Systeme International. This system, having wide international acceptance by standards institutions, provides units for such basic physical quantities as length (metre), mass (kilogram), energy (Joule) temperature (Kelvin), angle (radian) and time (second). From these a number of other units are derived.

Smog
The word derives from the combination of smoke and fog and thus succinctly describes the smoky fogs which London used to experience. It was, in fact, coined by Dr Des Voeux, the founder President of the National Smoke Abatement Society. Photochemical smog is the term applied to the phenomenon found in Los Angeles and certain other heavily motorised cities where reactions, particularly between oxides of nitrogen and hydrocarbons, under the influence of sunlight can produce poor visibility, a brown pall in the air, eye irritation and damage to materials and vegetation.

Smoke
This has a number of meanings including:
1) Small gas-borne liquid and/or solid particles formed by incomplete combustion of fuel and in the size range 0·001 to 1·0 μg.
2) In the Clean Air Act "smoke" is taken to include soot, ash, grit and gritty particles emitted in smoke.
3) Suspended matter collected on filter paper in accordance with BS 1747: Part 2.

Smoke Control Area
This describes an area which has been designated by a Local Authority as one in which only Authorised Fuels (q.v.) may be burned in accordance with the Clean Air Act.

Smoke Stain
This term is applied to the darkness of a filter through which air has been sampled. The filter retains smoke particles and the stain can be expressed as a concentration of equivalent standard smoke (q.v.).

Smuts
Small aggregates of soot, unburnt solids or fly ash which may be emitted from chimneys and then be deposited in the vicinity. In certain circumstances the production of sulphur trioxide during combustion can give rise to acid smuts which are corrosive.

Snap-sample
See Grab-sample.

Soiling (index)
The soiling or dirtying of a filter paper through which air has been sampled can be used as a measure of the smoke content of the air.
See also smoke stain and COH.

Soot
Aggregates of carbonaceous particles impregnated with tar formed by the incomplete combustion of carbonaceous material, particularly bituminous coal. They tend to adhere to the inside of the chimney etc.

Spark Ignition
The principle of fuel ignition in the normal petrol internal combustion engine where the compressed fuel/air mixture is ignited by an electric spark.

Specific Gravity
The specific gravity or relative density of something is its density (q.v.) relative to that of water under specified conditions.

Spectrophotometry
The measurement of the concentration of something by the amount of light emitted or absorbed of a colour (wavelength) characteristic of the thing being measured.

Stable (Compound/Atmosphere)
1) A stable compound is one which is not readily decomposed or not very reactive.
2) In describing the atmosphere it is frequently used to mean a state in which vertical air movement is restricted. An inversion may produce a stable layer.

Stack Solids
The solid content of the gas stream going up a stack or chimney.

Stagnation/Stagnant
A situation in which there is no flow. Air can stagnate in valleys trapped by an inversion. (q.v.).

Standard
Broadly a unit used as a basis of comparison but in respect of air quality it can have a number of different meanings. It can imply a commonly agreed level above which effects of some type or other are believed to occur. It can also represent an air quality or emission level which the regulations say must not be exceeded (either at all or for specified periods). The maximum permitted level of air contaminant as established by a legal authority. A British Standard refers to a standard specification from the B.S.I. (q.v.).

Standard Deviation
A widely used measure of the dispersion of a number of observations of some quantity. It is the square root of the average of the squares of the differences of each observation from the mean of those observations.

Standard Smoke
For certain smokes the relationship has been measured between the darkness of stains produced by sampling on a filter and separate gravimetric measurements of the smoke concentrations. This allows filter stains to be expressed in terms of a concentration of equivalent standard smoke.

Stoichiometric
The exact or fixed proportions of elements in a chemical compound or of reactants to produce a compound. Thus in common salt (NaCl) the stoichiometric ratio of sodium atoms to chlorine atoms is 1:1.

Stokes
Stokes systematised the subject of viscosity promulgating Stokes Law relating the factors controlling the movement of a spherical particle through a fluid. The Stokes diameter of a particle is the diameter of a sphere which would move in a fluid in a similar

fashion to the particle in question which may not be spherical.

Stomata
The small apertures or pores in a leaf epidermis (skin) or a young stem. They allow the passage of gases and vapours into and out of leaves. It can be damaging to a plant if the stomata are blocked, eg by fine dust or fungi.

S.T.P.
Standard Temperature and Pressure. Usually the same as NTP (q.v.) but sometimes referring to other conditions, eg 60°F and 30 inches of mercury.

Stratosphere
The earth's atmosphere above the tropopause (q.v.), some 8 to 80 km in depth. Its temperature does not vary with height and it contains little moisture.

Sulphate
Salts of sulphuric acid containing the SO_4 group of atoms. Sulphur dioxide emitted from the burning of sulphur in fuels is oxidised slowly in the atmosphere to sulphur trioxide which forms sulphuric acid with moisture and sulphates with basic materials such as ammonia or metals and their oxides. Sulphates so formed are particulates. Sea spray is a substantial natural source of airborne sulphate particles.

Sulphur Dioxide (SO_2)
This is the main product of the combustion of sulphur contained in fuels. Globally, much of the sulphur dioxide in the atmosphere comes from natural sources, but in highly developed and heavily populated regions the greater part of sulphur dioxide concentrations comes from fossil fuel combustion.

Sulphuric Acid (H_2SO_4)
Sulphur dioxide oxidises in the air to sulphur trioxide SO_3 which forms sulphuric acid with moisture. It is a corrosive acid.

Survey—surveillance
An air pollution survey is an examination of the condition of the air usually at a number of points. Surveillance implies surveying over time—keeping an eye on things.
Monitoring (q.v.) is often used in the same sense.

Synoptic
Affording an overall view. In meteorology, a synoptic chart displays the state of the atmosphere over a large area at one time. By extension, synoptic is used to refer to features, eg cyclones or anticyclones, which appear in such charts.

Suspended Particulates
A term describing particles which are too small to have an appreciable falling velocity and therefore tend to stay suspended in the atmosphere for a considerable period. By and large they are of 5 μm diameter or less.

Symbiosis/Symbiotic
Symbiosis (of which symbiotic is the adjective) is a phenomenon where there is a mutually beneficial relationship between two organisms or factors.

Synergism/Synergistic
The phenomenon in which the effect of two things together is greater than the sum of the effects of the things separately. The adjective is synergistic.

Tar
A thick, dark brown or black viscous liquid obtained by distilling of wood, coal, peat, crude oil etc.
The distillation need not be in a still. Some distillation can occur in the domestic grate and chimney.

Target
1) An objective. A certain air quality may be a desirable target to aim at.
2) In assessing pollution effects the word target is frequently used to describe things actually hit or affected by pollutants.

TEL
Tetra ethyl lead (TEL) and tetra methyl lead (TML) are the principal additives to petrol to raise the octane rating (q.v.) and thus reduce the tendency to knock (q.v.) in spark ignition internal combustion engines.

Telemetering
The transmission of signals from a measuring instrument by telephone line or radio to a distant point where the results can be displayed or recorded. Thus the levels of pollution at a number of locations can be displayed at a single point.

Terminal Settling Velocity
The maximum velocity reached by a falling particle when the gravitational force on it (its weight) is balanced by the viscous drag of the fluid through which it is falling.

T.L.C.
TLC, Threshold Limit Concentration= TLV (q.v.).

TLV
Threshold Limit Value. This is the concentration of any of a number of pollutants recommended as a maximum to which *healthy adult workers* may be exposed for eight hours a day five days a week without adverse effects. The list is compiled by the American Conference of Governmental Industrial Hygienists but is used extensively in many countries.
Although $^1/_{30}$ or $^1/_{40}$ of the TLV is often used as a rule of thumb guide to an acceptable ambient concentration of a pollutant for *the general public*, there are many exceptions and the ACGIH specifically warns against the practice.

Tonne
The metric ton equal to 1000 kg or 2204·6 lb whereas 1 ton equals 2240 lb.

Topography
The layout of an area in terms of height —the natural features and/or the buildings etc.

Toxicity
A measure of the poisonous or damaging effect of a substance on a living organism.

Tracer Technique
A method of studying pollutant behaviour in the air by the injection or release of a specifically identifiable substance. The subsequent distribution of the tracer is taken to be similar to that of the pollutant from the same starting point.

Tropopause
The boundary between the troposphere (q.v.) and the stratosphere (q.v.).

Troposphere
The lower part of the earth's atmosphere, some 9 to 20 km deep, in which the temperature generally decreases with height. It contains the air we breathe and in which weather processes occur.

Turbidity
1) The cloudiness of a liquid caused by fine suspended particles. More precisely it describes the reduction of light passing through the liquid (caused by the suspended particles).
2) In meteorology any condition of the atmosphere which reduces its transparency to light; a measure of the reduction of transparency — normally excluding cloud.

Turbulence
A motion of the wind in a highly irregular manner both in speed and direction. It is the main mechanism of diffusion of pollutants in the air.

Unstable
1) An unstable chemical compound is one which is easily decomposed or reacted with.
2) An unstable atmosphere is one in which turbulent motions tend to grow thereby substantially aiding the dispersion of pollution.

Vanadium
A metallic element some of whose compounds can be poisonous under

certain conditions. It occurs in coal and fuel oil in varying amounts and is contained in the ash or unburnt solids emitted from combustion of these fuels.

Vapour
A gas is said to be a vapour if, at the temperature concerned, it can be liquified by pressure alone.

Vapour Pressure
The pressure exerted by a vapour, either alone or mixed with other gases. The saturated vapour pressure of a substance at any temperature is pressure of the vapour of the substance in equilibrium with its liquid form.

Variance
A statistical term—the square of the standard deviation (q.v.) ie the average of the squares of the deviations of a number of observations of a quantity from their mean value.

VDI
Verein Deutscher Ingenieure, the Association of German Engineers, produces standards and recommendations (codes of practice) in a number of technical areas including air pollution control.

Ventilation
1) The process of replacing contaminated or stale air by fresh air.
2) The movement and circulation of outdoor air.
3) The volume of air entering or leaving the lungs in one respiratory cycle.

Venturi
The name Venturi is applied to a tube which is constricted and then opens out again and can be used:
1) to meter the flow of gas
2) to assist the scrubbing of a gas by a liquid.

Viscosity
The resistance of a fluid to shear forces and hence to flow. The viscosity of syrup is greater than that of water.

Visibility
A measure of clearness of the air expressing how far objects can be clearly seen under specified conditions. Light absorption and scattering by aerosols are the main causes of reduced visibility.

Warm Front
The sharp boundary between two extensive air masses where warm air is replacing cold air.

Washing (Gas washing)
See scrubbing.

Washout
The removal of gases, sometimes particles, from the atmosphere by their solution or attachment to rain drops as they fall (cf. rainout).

Windrose
A diagram showing the frequency and strength of winds of various directions over a period for a particular locality.

Wind Shear
The change in speed and direction of the wind, usually with height.

Zinc (Zu)
A metallic element some of whose compounds are poisonous, particularly to plants.

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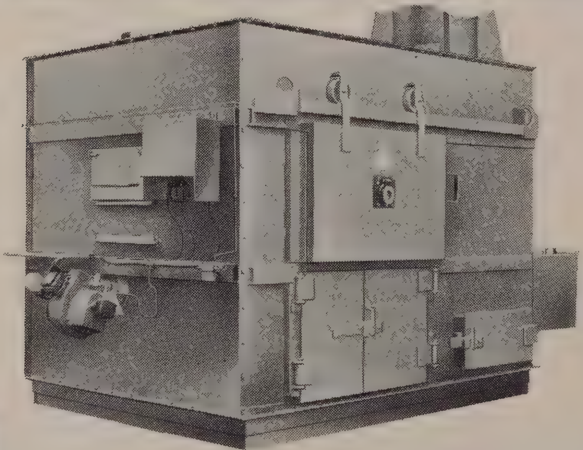

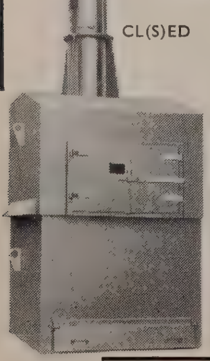

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Estimates of Air Pollution in the United Kingdom in the Year 1971-72

This table was first shown in the Summer 1973 edition of 'Clean Air', when an incorrect figure was given for 'Sulphur oxides overall total'. This reprint shows correct figures.

Table 1

Estimates of Pollution by Smoke and Oxides of Sulphur in Million Metric Tonnes from the Main Uses of Primary Forms of Energy

(*one metric tonne=0·9842 long ton*)

Estimates prepared by Albert Parker, CBE, DSc.

Figures for quantities of forms of energy were derived from the Digest of United Kingdom Energy Statistics issued in 1972 by the Department of Trade and Industry. The percentages of sulphur in the various grades of fuel used in making the estimates of pollution by sulphur oxides were provided by the coal, oil and electricity supply industries.

Form of Energy and Class of Consumer	*Quantity of Energy*	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miners' coal	15·2	0·47
Railways	0·1	small
Industrial and miscellaneous including collieries	17·2	0·05
	32·5	0·52
Sulphur oxides		
Coal		
Domestic, including miners' coal	15·2	0·29
Electricity power stations	68·9	1·99
Railways	0·1	small
Collieries	1·3	0·03
Industrial and miscellaneous	17·2	0·42
Coke ovens	20·5	0·09
Gas supply industry for gas making	1·1	0·01
Low temperature carbonization plants	2·5	0·01
Patent fuel plants	1·4	small
	128·2	2·84
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels	5·1	0·08
Industrial and miscellaneous	3·0	0·05
	8·1	0·13
Oil		
Domestic	3·0	0·02
Industrial and commercial	53·4	2·31
Gas supply industry	1·9	small
Road transport	20·1	0·05
Railways	1·1	0·02
Marine craft (inland)	1·4	0·04
	80·9	2·44
Sulphur oxides overall total		5·41
Coal equivalent in m. tonnes of energy consumption in 1971-72		
Hydro-electricity	1·8	0·5%
Nuclear-electricity	9·8	3·0%
Natural gas	26·2	8·0%
Coal	140·9	42·9%
Oil (1 tonne=1·7 tonne of coal)	149·8	45·6%
Total coal equivalent	328·5	100·0

The amount of 53·4 m. tonnes of oil used in 1971-72 for industrial and commercial purposes is equivalent in heating value to about 90·8 m. tonnes of coal, which if used for the same purposes would have produced about 0·27 m. tonnes of smoke and 2·3 m. tonnes of oxides of sulphur. The overall total amount of 5·41 m. tonnes of oxides of sulphur is 1·647 per cent of the total coal equivalent of 328·5 m. tonnes.

Estimates of Air Pollution in the United Kingdom in the Year 1972-73

Table 1

Estimates of Pollution by Smoke and Oxides of Sulphur in Million Metric Tonnes from the Main Uses of Primary Forms of Energy

(*one metric tonne=0·9842 long ton*)

Estimates prepared by Albert Parker, CBE, DSc.

Figures for quantities of forms of energy were derived from the United Kingdom Energy Statistics issued in 1973 by the Department of Trade and Industry. The percentages of sulphur in the various grades of fuel used in making the estimates of pollution by sulphur oxides were provided by the coal, oil and electricity supply industries.

Form of Energy and Class of Consumer	*Quantity of Energy*	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miner's coal	14·5	0·45
Railways	0·1	small
Industrial and miscellaneous including collieries	15·9	0·05
	30·5	0·50
Sulphur oxides		
Coal		
Domestic, including miners' coal	14·5	0·28
Electricity power stations	66·7	1·57
Railways	0·1	small
Collieries	1·4	0·03
Industrial and miscellaneous	14·5	0·34
Coke ovens	20·4	0·10
Gas supply industry for gas making	0·6	0·01
Low temperature carbonisation plants	3·1	0·01
Patent fuel plants	1·5	small
	122·8	2·34
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels	4·7	0·08
Industrial and miscellaneous	2·9	0·05
	7·6	0·13
Oil		
Domestic	3·5	0·02
Industrial and commercial	57·9	2·61
Gas supply industry	1·6	small
Road transport	21·2	0·05
Railways	1·0	0·02
Marine craft (inland)	1·5	0·03
	86·7	2·73
Sulphur oxides overall total		5·20

Coal equivalents in m. tonnes of energy consumption in 1972-73

Hydro-electricity	2·0	0·6%
Nuclear-electricity	10·7	3·2%
Natural gas	37·3	11·2%
Coal	122·8	36·9%
Oil (1 tonne=1·7 tonne of coal)	160·1	48·1%
Total coal equivalent	332·9	100·0

The amount of 57·9 m. tonnes of oil used in 1972-73 for industrial and commercial purposes is equivalent in heating value to about 98·4 m. tonnes of coal, which if used for the same purposes would have produced about 0·29 m. tonnes of smoke and 2·5 m. tonnes of oxides of sulphur. The overall total amount of 5·20 m. tonnes of oxides of sulphur is 1·562 per cent of the total coal equivalent of 332·9 m. tonnes.

Table 2

Estimates of Pollutants from Road Vehicles in the United Kingdom in the Year 1972-73 in Million Tonnes

Consumption of Motor Spirit 15·90 m. tonnes
Consumption of Derv Fuel 5·25 m. tonnes

Pollutant	*Petrol Engines*	*Diesel Engines*
Carbon monoxide	7·5	0·11
Hydrocarbons	0·38	0·022
Aldehydes	0·01	0·003
Oxides of nitrogen	0·25	0·08
Oxides of sulphur	0·016	0·03

The estimated quantity of carbon monoxide discharged into the air from the other industrial and domestic uses of all fuels in the year 1972-73 is about 9 m. tonnes including about 3·5 m. tonnes from domestic heating appliances. These discharges are above ground level whereas the discharges from road vehicles are at ground level.

Lead

The total amount of lead in the lead alkyl compounds added to the 15·9 m. tonnes of motor spirit used in the United Kingdom in 1972-73 was about 11,750 tonnes. The lead would be converted to complex compounds and about one-third would be retained partly in the lubricating oil and partly in the exhaust system. This means that the amount of lead in the compounds discharged in the exhaust gases from petrol driven vehicles in 1972-73 was about 7,800 tonnes.

Comparison of Air Pollution Statistics

by Albert Parker, CBE, DSc.

The figures in the following Tables A and B, prepared by Albert Parker, CBE, DSc., were derived from the statistics issued in 1955 by the Ministry of Fuel and Power, from 1956 to 1969 by the Ministry of Power, in 1970 by the Ministry of Technology and from 1971 to 1973 by the Department of Trade and Industry. The publications are available from H.M. Stationery Office. The factors used to obtain the coal equivalents given in Table A were

1 tonne of petroleum=1·7 tonne of coal.
280 therms of natural gas and colliery methane=1 tonne of coal.

Nuclear and hydro electricity were converted to the amount of coal needed to produce the same amount of electricity at the efficiency of contemporary steam power stations.

Table A.—Coal Equivalents of the Primary Forms of Energy used in the United Kingdom in 1938, 1956, and Each Year from 1960 to 1972.

Quantities in Million Metric Tonnes

Year	*Coal*	*Oil*	*Hydro Electricity*	*Nuclear Electricity*	*Natural Gas*	*Total*	*Per Capita Tonnes*
1938	178·5	12·6	0·7	—	—	191·8	4·03
1956	217·4	38·1	1·3	—	—	256·8	5·03
1960	198·6	66·6	1·7	0·9	0·1	267·9	5·09
1961	193·1	72·1	2·1	1·1	0·1	268·5	5·08
1962	194·0	79·9	2·1	1·5	0·1	277·6	5·18
1963	196·9	86·7	1·8	2·5	0·2	288·1	5·37
1964	189·6	94·8	1·9	3·2	0·3	289·8	5·35
1965	187·6	104·4	2·3	6·1	1·2	301·6	5·50
1966	176·7	113·5	2·4	7·9	1·1	301·6	5·49
1967	165·6	121·2	2·7	9·0	1·9	300·4	5·46
1968	167·1	127·9	2·2	10·3	4·5	312·0	5·64
1969	163·7	137·9	2·0	10·7	8·5	322·8	5·81
1970	156·9	147·9	2·6	9·6	16·2	333·2	5·98
1971	140·9	149·7	1·8	9·9	26·2	328·5	5·91
1972	122·8	160·1	2·0	10·7	37·3	332·9	5·96

Table B.—Quantities of Coal used in the United Kingdom in 1938, 1956 and Each Year from 1960 to 1972 in Grates or Furnaces that may cause Smoke Emission.

Million Metric Tonnes

Year	*Domestic excluding Miners'*	*Miner's Coal*	*Railways*	*Power Stations*	*Industrial* Miscellaneous and Collieries*
1938	47·3	4·7	13·6	15·3	61·1
1956	31·1	5·4	12·3	46·3	63·6
1960	29·6	5·1	9·1	53·5	48·3
1961	27·5	4·8	7·8	56·3	46·1
1962	27·9	4·8	6·2	61·4	43·9
1963	27·3	4·7	5·0	67·9	42·5
1964	23·4	4·4	3·9	68·5	40·5
1965	22·8	4·3	2·8	70·4	39·4
1966	21·2	3·9	1·7	69·0	36·6
1967	19·1	3·7	0·8	67·7	34·3
1968	18·4	3·3	0·2	75·6	29·7
1969	17·1	2·9	0·2	77·1	27·8
1970	15·4	2·7	0·1	77·2	25·6
1971	13·1	2·5	0·1	68·9	18·5
1972	10·6	2·2	0·1	66·7	15·9

* *excluding coke ovens, gas supply industry and plants for making solid smokeless fuels.*

Table C.—Estimates of Air Pollution by Smoke and Oxides of Sulphur from the Uses of Coal, Coke and Oil in the United Kingdom in 1938, 1956 and Each Year from 1960 to 1972.

Estimates made by Albert Parker, CBE, DSc.

Million Metric Tonnes

	Smoke		*Oxides of Sulphur*			
Year	*Domestic*	*Total*	*Coal*	*Coke**	*Oil*	*Total*
1938	1·74	2·75	3·89	0·24	0·06	4·19
1956	1·28	2·29	4·52	0·36	0·54	5·42
1960	1·21	1·47	4·37	0·36	1·26	5·99
1961	1·20	1·44	4·30	0·37	1·38	6·05
1962	1·18	1·42	4·32	0·36	1·51	6·19
1963	1·08	1·22	4·51	0·35	1·62	6·48
1964	0·98	1·14	4·34	0·31	1·74	6·39
1965	0·88	1·03	4·31	0·31	1·91	6·53
1966	0·84	0·98	4·03	0·29	2·05	6·37
1967	0·76	0·88	3·70	0·28	2·12	6·10
1968	0·75	0·84	3·72	0·29	2·13	6·14
1969	0·70	0·78	3·69	0·26	2·31	6·26
1970	0·64	0·72	3·40	0·17	2·50	6·07
1971	0·47	0·52	2·84	0·13	2·44	5·41
1972	0·45	0·50	2·34	0·13	2·73	5·20

* *including other solid smokeless fuels.*

Observations on Tables A, B, and C

Table A

The figures in Table A show that the coal equivalent of the primary sources of energy used in the United Kingdom increased by about 74 per cent from 191·8 m. tonnes in 1938 to 332·9 m. tonnes in 1972. Over that period the population rose by nearly 18 per cent from 47·5 m. to 55·9 m., so that the coal equivalent per capita increased by 48 per cent from 4·03 to 5·96 tonnes. The proportion of the coal equivalent provided by coal decreased from 93 per cent in 1938 to 37 per cent in 1972, while the percentage provided by oil rose from 6·6 in 1938 to 48 in 1972. Throughout the period 1938 to 1972, hydro electricity provided less than 1 per cent of the total coal equivalent; nuclear electricity was less than 1 per cent from 1960 to 1963 and then increased to about 3 per cent over the years 1967 to 1972. Natural gas provided less than 1 per cent from 1960 to 1967 and then rose each year to reach 11 per cent in 1972. As a result, of the coal equivalent of the total consumption of primary forms of energy in 1972, the percentages were oil 48, coal 37, natural gas 11, nuclear electricity 3 and hydro electricity less than 1.

Table B

The burning of bituminous coal in domestic open grates leads to the emission of much more smoke per tonne of coal than any of the other uses of coal given in Table B. The domestic use of coal, excluding miners' coal, fell from 47·3 m. tonnes in 1938 to 10·6 m. tonnes in 1972. The main reasons for this great decrease are first that during the war (1939-45), coal and coke for domestic use were rationed. In consequence, householders began to use more electricity and gas for heating and decided that these were more convenient and cleaner than heating by coal. Secondly, in 1956 there was the Clean Air Act which has enabled local authorities to establish smoke control areas in which the burning of bituminous coal in open domestic grates is prohibited. It was a few years before an appreciable number of smoke control areas had been established; progress in this direction has continued but not so rapidly as desirable. Thirdly, since 1945 there has been an increase in the number of housewives taking employment; this has led to an increasing demand for convenient gas and electric methods of heating.

It is difficult to estimate the relative effects of the three factors. The reduction in the amount of concessionary coal to miners from 5·4 m. tonnes in 1956 to 2·2 m. tonnes in 1972 was due to a substantial reduction in the number engaged in the deep mining of coal.

From 1956 to 1970, steam-driven railway locomotives, which emitted smoke, were steadily replaced by diesel engines and electric traction so that the consumption of coal by the railways fell from 12·3 m. tonnes in 1956 to 0·1 m. tonnes in 1970. The coal consumption by power stations increased from 15·3 m. tonnes in 1938 to 46·3 m. tonnes in 1956 and 70·4 m. tonnes in 1965, with later fluctuations, and a maximum of 77·2 m. tonnes in 1970. Power stations also consumed considerable quantities of oil. Industrial undertakings and collieries reduced their consumption of coal from 63·6 m. tonnes in 1956 to 15·9 m. tonnes in 1972 by replacing coal by oil, by electricity from the public supply, and to some extent, during 1970 to 1972, by natural gas.

Table C

The observations on the figures in Tables A and B give the reasons for the great reduction in the emission of smoke from domestic open fires. The percentage reduction in smoke emission from the uses of coal by industry for raising steam and heating furnaces was greater than the percentage reduction in the amount of coal used. This was partly due to the Clean Air Act which indirectly stimulated efforts to improve the efficiency of use of coal by industry. The emission of smoke from the use of coal by industry and the railways has been reduced over the years 1956 to 1972 by 95 per cent from 1·01 to 0·05 m. tonnes. Over the same period, the emission of smoke from domestic fires has been reduced by 65 per cent from 1·28 to 0·45 m. tonnes. In 1956, of the 2·29 m. tonnes of smoke, 56 per cent was from domestic fires and 44 per cent from the uses of coal by industry and the railways. In 1972, of the 0·50 m. tonnes of smoke emitted, 90 per cent was from domestic fires. It is clear that further effort should be made to reduce smoke emission from domestic chimneys.

The estimated emission of oxides of sulphur from the uses of coal, coke and oil rose from 5·4 m. tonnes in 1956 to 6·5 m. tonnes in 1965, and then declined gradually to 5·2 m. tonnes in 1972. Over the years 1956 to 1969, the amount of oxides of sulphur each year was approximately in proportion to the coal equivalent of the coal and oil consumed. In 1971 and 1972, there was some reduction in the average percentage of sulphur in the coal and oil used.

A. Parker

INTERNATIONAL CLEAN AIR AND POLLUTION CONTROL CONFERENCE

incorporating the 42nd ANNUAL CLEAN AIR CONFERENCE

20th—24th OCTOBER 1975

BRIGHTON

Monday October 20th	20.30	Opening Session (Formal)
Tuesday October 21st	10.00	**International Attitudes to the Control of Pollution**
	1.	A Comparison of Approaches. (U.K.)
	2.	The U.K. Approach and its Application
		(a) By central government (U.K.)
		(b) By local government (U.K.)
	3.	Europe—The EEC Philosophy of Control (EEC)
	14.30	
	4.	Europe—The EEC Approach to Medical Standards (EEC)
	5.	A New Approach to Standard (Netherlands)
Wednesday October 22nd	09.30	**Energy from the Continental Shelf** (International/U.K.)
	6.	Geology and Exploration
	7.	Procurement
	8.	The Future
Thursday October 23rd	10.00	**Technical Aspects of Control of Industrial Pollution**
	9.	Gaseous Emissions (France)
	10.	Effluents (W. Germany)
	11.	Solid and Toxic Wastes (U.K.)
	14.30	**Conservation of Resources**
	12.	Human Resources (U.S.A.)
	13.	Energy and Raw Materials (U.K.)
Friday October 24th	09.30	**Pollution from Road Vehicles**
	14.	Europe—The EEC Philosophy of Control (EEC)
	15.	Technical Problems of Control (U.K.)
	16.	Noise and its Control (U.K.)
	12.00	Closing Address

SMOKE CONTROL AREAS

Programmes and Progress

The following lists contain the names of the new local authority areas as of April 1st 1974. Due to the local government reorganization in certain parts of the country, figures will differ markedly from previous years, and many 'TARGET DATES FOR PROGRAMME COMPLETION' and 'FINAL ACREAGE WHEN COMPLETED' figures have not yet been decided, due to this major structural change.

There is no longer a differentiation between 'black' and 'white' areas. The figures have been compiled directly from information obtained from the local authority concerned.

The figures are for the position on 30 June 1974 and some authorities' figures will have changed since this date.

An asterisk with bold type indicates completed programmes. The new British Isles divisions, issued by the Department of the Environment are listed below.

DEPARTMENT OF THE ENVIRONMENT DIVISIONS

NORTHERN	Northumberland, Cumbria, Durham, Cleveland, Tyne & West.
NORTH WESTERN	Lancashire, Merseyside, Cheshire.
YORKSHIRE & HUMBERSIDE	North Yorkshire, West Yorkshire, South Yorkshire, Humberside.
WEST MIDLANDS	Herefordshire, Worcester, Shropshire, Staffordshire, West Midlands, Warwickshire.
EAST MIDLANDS	Lincolnshire, Northamptonshire, Leicester, Nottinghamshire, Derbyshire.
EAST ANGLIA	Norfolk, Suffolk, Cambridgeshire.
GREATER LONDON	
SOUTH EASTERN	Essex, Hertfordshire, Beds, Bucks, Oxon, Berks, Hants, I.O.W., Surrey, Sussex, Kent.
SOUTH WESTERN	Gloucs., Wilts, Dorset, Cornwall.
SCOTLAND	
WALES	
NORTHERN IRELAND	

	1 Target Date	*2 Final Acreage*	*3 Acreage (In Oper.) 30.6.74*	*4 Premises (In Oper.) 30.6.74*
NORTHERN				
Blyth Valley DC (Northumberland)	1985	17,649	2,012	5,166
Carlisle DC (Cumbria)	—	6,092	—	—
Darlington CB (Co. Durham)	1983	49,375	2,136	8,745
Durham BC (Co. Durham)	—	47,000	—	—
Easington DC (Co. Durham)	1979	3,500	1,525	3,483
Gateshead (M) (Tyne & Wear)	1980	35,372·36	7,480·34	28,378
Hartlepool DC (Cleveland)	1979	12,000	4,385	19,070
Loughborough DC (Cleveland)	—	—	5,054	9,201
Middlesbrough DC (Cleveland)	1978	11,400	9,858	40,989
Newcastle-upon-Tyne (M) (Tyne & Wear)	1977	28,414	8,166	52,965
South Tyneside (M) (Tyne & Wear)	1981	15,604	9,713·72	32,230
Stockton-on-Tees DC (Cleveland)	—	48,061	7,634	26,365
Sunderland (M) (Tyne & Wear)	1978	34,530	3,206·8	16,531
NORTH WESTERN				
Blackburn DC (Lancs)	No figures received from L.A.			
Bolton (M) (Gter. Manchester)	1981	35,000	12,437	46,004
Burnley CB (Lancs.)	1977/8	33,088	6,264	33,741
Bury (M) (Gter. Manchester)	1980	24,506	15,691	43,782
Ellesmere Port DC (Cheshire)	1984	18,299	3,127·06	11,644
Halton DC (Cheshire)	—	—	6,398	21,748
Hyndburn DC (Lancs)	1981	18,050	5,872	13,646
Knowsley (M) (Merseyside)	1985	9,810	61,090	32,195
Leeds (M) (W. Yorks)	1980	134,916	59,499	178,766
Liverpool (M) (Merseyside)	—	27,819	18,327	101,307
Macclesfield BC (Cheshire)	—	130,000	305·35	2,632
Manchester (M) (Gter. Manchester)	1977	28,920	20,553	122,961
Oldham (M) (Gter. Manchester)	1978	34,871	12,437	56,163
Pendle DC (Lancs)	1976	7,131	5,592	23,371
Preston BC (Lancs)	—	35,188	4,059	25,419
Ribble Valley DC (Lancs)	New programme not yet decided			
Rochdale (M) (Gter. Manchester)	1980	39,306	18,143	52,000
Rossendale DC (Lancs)	1985	34,170	1,158	1,740
St. Helens (M) (Merseyside)	1979/80	32,201	5,553·15	18,905

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.74*	*4* *Premises (In Oper.) 30.6.74*
Salford (M) (Gter. Manchester)	No figures received from L.A.			
Sefton (M) (Merseyside)	No figures received from L.A.			
South Ribble DC (Lancs)	1983	27,454	246	700
Stockport (M) (Gter. Manchester)	1980	31,147	18,554	69,100
Tameside (M) (Gter. Manchester)	1980	25,519	17,110	69,480
Trafford (M) (Gter. Manchester)	1974	5,873	706	1,570
Vale Royal DC (Cheshire)	—	—	6,581	8,598
Warrington DC (Cheshire)	1980	43,527	22,374	47,449
West Lancashire DC	1984	80,709	3,369	9,894
Wigan (M) (Gter. Manchester)	1983	52,918	12,956	35,568
Wirral (M) (Merseyside)	1981	32,176	12,950	64,343
YORKSHIRE AND HUMBERSIDE				
Barnsley (M) (S. Yorks)	1985	81,243	6,099	11,215
Bradford (M) (W. Yorks)	1978	91,444	50,838	180,106
Calderdale (M) (W. Yorks)	1980	88,400	53,503	58,650
Craven DC (N. Yorks)	1983	4,759	3,099	4,248
Derwentside DC (Co. Durham)	—	—	109	2,760
Doncaster (M) S. Yorks)	—	139,000	12,281	26,733
Glanford DC (Humberside)	—	144,738	1,526	489
Harrogate DC (N. Yorks)	—	—	532	2,891
Kingston-upon-Hull (Humberside)	1984	17,599	8,476	38,700
Kirklees (M) (W. Yorks)	1981/2	101,326	25,269	51,763
Rotherham (M) (S. Yorks)	—	69,881	6,365	23,273
Scunthorpe DC (Humberside)	1978	7,895	3,528	14,870
Sheffield (M) (S. Yorks)	1979	90,835	47,369	196,239
Wakefield (M) (W. Yorks)	1989	83,880	9,803	26,784
York DC (N. Yorks)	1980	7,295	2,483	7,840
WEST MIDLANDS				
Birmingham (M) (W. Midlands)	1980	65,309	38,715·6	229,670
Cannock Chase DC (Staffs)	New programme not yet decided			
Coventry (M) (W. Midlands)	1983	23,855	7,952	26,707
Dudley (M) (W. Midlands)	1983	24,768	16,625	6,400
East Staffordshire DC (Staffs)	—	—	899	4,021
Newcastle-under-Lyme DC (Staffs)	—	52,169	3,952	12,773
North Warwickshire DC (Warwicks)	1985	14,883	245	1,330
Nuneaton DC (Warwicks)	1982	19,587	6,635	14,000
Rugby DC (Warwicks)	1984	7,010	3,863	10,698
Sandwell (M) (W. Midlands)	1990	21,175	5,881	28,123
Shrewsbury DC (Salop)	—	148,928	379	2,499
Solihull (M) (W. Midlands)	1990	16,489	5,484	31,952
South Staffordshire DC (Staffs)	1986	6,000	171	689
Stafford DC (Staffs)	—	110,000	—	—
Staffordshire Moorlands DC (Staffs)	—	—	96	460
Stoke-on-Trent DC (Staffs)	1986	22,949	10,329	32,035
Tamworth DC (Staffs)	1980	7,647	3,563	6,574
Walsall (M) (W. Midl)	1980	23,000	7,586	22,286
Warwick DC (Warwicks)	1984	69,791	2,180	8,479
Wolverhampton (M) (W. Midl)	1986	17,004	4,808	30,205
Worcester (Hereford & Worcs)	1986	7,877	—	—
Wrekin DC (Salop)	1994	72,000	318·7	1,360
EAST MIDLANDS				
Amber Valley DC (Derby)	—	—	2,234	2,324
Ashfield DC (Notts)	—	27,520	9,462	12,024
Bassetlaw DC (Notts) (Worksop only)	1981	17,000	1,373	1,232
Blaby DC (Leics)	—	—	1,128	3,301
Bolsover DC (Derby)	—	39,623	570	1,464
Broxtowe DC (Notts)	1981	12,716	6,070	21,872
Chesterfield DC (Derby)	1980	16,265	2,935	10,303
Corby DC (N'hants)	1982	3,703	1,136	7,600
Derby CB (Derby)	1979	19,282	11,979	38,694
Erewash DC (Derby)	—	26,955	1,507·5	5,779
Gedling DC (Notts)	—	8,523	1,810	10,959
High Peak DC (Derby)	1979	9,661	2,011·01	6,459

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.74*	*4* *Premises (In Oper.) 30.6.74*
Hinckley & Bosworth DC (Leics)	—	73,537	—	—
Kettering DC (N'hants)	—	57,737	—	—
Leicester City Council (Leics)	1975	18,144	14,591	72,441
Lincoln DC (Lincs)	—	8,828	2,854	3,900
Mansfield DC (Notts)	1990	18,997	5,729	13,798
Northampton DC (N'hants)	1985	19,181	6,143·8	5,983
North East Derbyshire DC (Derby)	1984	68,101	16,657	19,079
Nottingham DC (Notts)	1985	18,364	7,975	31,328
Rushcliffe DC (Notts)	1977	3,044·8	1,037·8	2,866
South Kesteven DC (Lincs)	—	—	1,513	4,262
EAST ANGLIA				
Cambridge DC (Cambs)	No figures received from L.A.			
Norwich DC (Norfolk)	—	9,655	1,435	1,066
Peterborough DC (Cambs)	—	82,424	2,929	4,737
West Norfolk DC (Norfolk)	—	—	683·21	2,088
SOUTH WEST				
Bath DC (Avon)	1990	7,092	—	—
Bristol DC (Avon)	1980	27,068	7,519	28,697
Cheltenham DC (Gloucs)	—	—	841·25	2,427
Exeter DC (Devon)	1984	10,952	5,786	13,214
SOUTH EAST				
Aylesbury Vale DC (Bucks) (Town only)	1980	3,954	912·5	4,887
Basildon DC (Essex)	1978	—	4,528	20,888
Bedford DC (Beds)	—	—	2,978	10,630
Bracknell DC (Berks)	1975	3,286	2,465	5,874
Brentwood DC (Essex)	—	—	227	2,856
Brighton DC (E. Sx)	1990	14,613	—	—
Broxbourne DC (Herts)	1980	12,903	1,951	8,579
Canterbury DC (Kent)	—	4,810	200	700
Crawley DC (W. Sussex)	—	9,013	5,622	28,500
Dacorum DC (Herts)	—	51,895	3,517	Not available
Dartford	1981	17,267	4,179	12,898
Gillingham DC (Kent)	1980	11,123	8,314	13,854
Guildford DC (Surrey)	1984	7,184	—	—
***Harlow DC (Essex)**	**1964**	**5,889**	**5,889**	**23,556**
Hertsmere DC (Herts)	—	21,031	1,619·75	5,036
Luton DC (Beds)	1980	10,695	4,904	26,318
Medway DC (Kent)	—	9,579	6,383	17,917
Milton Keynes DC (Bucks) (Bletchley only)	1982	—	695	42,000
Oxford City Council	1985	8,785	2,394	9,641
Portsmouth City Council (Hants)	1988	9,249	43·45	1,257
Reading DC (Berks)	1980	9,106	4,194	18,942
Sevenoaks DC (Kent)	—	2,325	1,341	3,684
Slough DC (Berks)	1980	6,810	3,555	18,271
Southampton City (Hants)	1985	12,058	2,432	15,200
Spelthorne BC (Surrey)	1976	13,880	8,271	24,348
Thurrock DC (Essex)	1985	40,000	5,312	14,689
Watford DC (Herts)	1980	5,275	2,153	10,000
Windsor & Maidenhead (Berks) Royal Borough	—	—	831	2,655
Wycombe (Bucks)	1977	7,091	3,818·6	16,422
GREATER LONDON				
***City of London**	**1955**	**677**	**677**	**21,700**
Barking	1977	8,877	5,947·7	46,497
Barnet	1976	22,123	13,817	88,072
Bexley	1975	15,896	12,450	65,950
Brent	1975	10,934	10,923	85,458
Bromley	1977	37,583	18,608	76,439
***Camden**	**1968**	**5,364**	**5,364**	**87,303**
Croydon	1978	21,395	13,164	98,246
***Ealing**	**1972**	**13,708**	**13,708**	**91,057**
Enfield	1975	21,000	17,866	77,426

	1 *Target Date*	*2* *Final Acreage*	*3* *Acreage (In Oper.) 30.6.74*	*4* *Premises (In Oper.) 30.6.74*
***Greenwich**	**1972**	**11,724**	**11,724**	**75,673**
***Hackney**	**1967**	**4,814**	**4,814**	**90,507**
***Hammersmith**	**1967**	**3,950**	**3,950**	**72,559**
***Haringey**	**1968**	**7,491**	**7,491**	**90,575**
Harrow	1975	12,555	10,359	60,943
Havering	1976	29,650	15,559	59,680
Hillingdon	1978	27·58	17·37	56,420
***Hounslow**	**1972**	**14,469**	**14,469**	**73,646**
***Islington**	**1969**	**3,679**	**3,679**	**82,000**
***Kensington & Chelsea (Royal)**	**1972**	**2,950**	**2,950**	**25,288**
Kingston-upon-Thames (Royal)	1977	9,821	5,129	38,171
Lambeth	1976	6,727	4,480·013	81·123
Lewisham	1975	8,579	8,185	77,624
Merton	1975	9,381	8,100	52,776
Newham	1977	9,091·25	3,331·5	49,121
***Redbridge**	**1971**	**13,983**	**13,983**	**67,658**
***Richmond-upon-Thames**	**1972**	**12,873**	**13,873**	**75,400**
Southwark	1975/6	6,981	5,399	85,075
Sutton	1976	10,732	6,906	45,808
***Tower Hamlets**	**1968**	**4,876**	**4,876**	**42,440**
Waltham Forest	1978	9,805	7,243	64,897
Wandsworth	1975	9,113	7,942	92,343
***Westminster (City)**	**1970**	**5,334**	**5,334**	**13,021**
NORTHERN IRELAND				
Antrim	1976	740	710	4,344
Armagh	1980	2,400	579	2,984
Ballymena B	Programme deferred	157,310	325	890
Belfast City	1989	15,815	2,274	15,492
Castlereagh	1979	5,142	3,165	13,188
Craigavon	1980	3,641	—	2,706
Down	—	—	482	630
Larne	1976	2,381	11	290
Londonderry	—	—	74	546
Newtownabbey	—	—	1,489	4,124
North Down	—	—	176	765
***Strabane**	**1974**	**54**	**54**	**750**
SCOTLAND				
Airdrie	1984	2,909	98·115	499
Alloa	1976	1,355	272	1,134
Ards	—	—	105·3	735
Barrhead	1976	1,154	1,012	5,290
***Bearsden**	**1973**	**3,708**	**3,078**	**8,080**
Bishopsbriggs	1975	3,595	1,962	3,397
Burntisland	1977	600	—	—
Clackmannan County	1976	2,095	370	1,997
Clydebank	1975	2,980	2,471·22	12,483
***Coatbridge**	**1970**	**4,339**	**4,339**	**16,210**
Denny and Dunipace	—	906	112·5	714
Dumbarton Burgh	1974	2,507·58	1,620·75	5,349
Dumfries	1984	7,674	86·50	873
Dunfermline S.	1979/80	12,855	7,369	47,443
***East Kilbride S.**	**1972**	**6,658**	**6,658**	**20,737**
Edinburgh	1982	34,781	12,249	49,586
Falkirk	1975	4,825	3,540	10,264
Fife County	—	5,765	5,180	4,207
***Galashiels B.**	**1972**	**1,766·24**	**1,766·24**	**4,367**
Glasgow	1980	39,725	27,163	187,067
Gomock	1976/7	639	—	—
Grangemouth	1980	4,797	673·35	4,632
Hamilton	1980	3,817	907	6,023
Hawick	1982	1,240	209	909
Johnstone	—	—	243	1,353
***Kilmarnock**	**1972**	**77**	**77**	**304**

	1 *Target Date*	2 *Final Acreage*	3 *Acreage (In Oper.) 30.6.74*	4 *Premises (In Oper.) 30.6.74*
Kirkaldy	1985/90	5,503	363·63	326
Lanark County	—	—	1,572	10,519
Midlothian County	—	—	4,137	4,704
Milngavie	1975	1,800	944·80	2,960
Monifieth	—	1,274	—	—
Motherwell	—	6,987·46	773·33	3,364
Paisley	1975	6,558	5,953	32,347
***Port Glasgow**	**1973**	**1,461**	**1,461**	**6,753**
***Renfrew Burgh**	**1974**	**2,315**	**2,315**	**7,668**
Rutherglen	1976	1,228	675·5	4,892
Stirling County	1975	—	6,595	13,217
West Lothian County	—	69,959	2,382	11
		WALES		
Alyn and Deeside (W)	—	53	53	361
Newport West & Gwent DC	—	—	56	651
Wrexham Maelor (W)	—	—	1,757	7,340

SMOKE CONTROL AREAS

Progress Report

Position at 30th June 1974

(Figures supplied by the Department of the Environment, The Welsh Office, The Northern Ireland Ministry of Development and the Scottish Development Department).

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 31.3.74 *Acres* .. *Premises* ..	4,339	1,354,345	6,127,295	19	2,855	10,499	228	121,430	524,316	58	14,107	34,456
Smoke Control Orders Confirmed (31.3.74-30.6.74) *Acres* .. *Premises* ..	57	30,396	91,786	—	—	—	4	2,145	11,978	—	—	—
Totals ..	**4,396**	**1,384,741**	**6,219,081**	**19**	**2,855**	**10,499**	**232**	**123,575**	**536,294**	**58**	**14,107**	**34,456**
Smoke Control Orders Submitted (31.3.74-30.6.74) *Acres* .. *Premises* ..	24	14,179	38,915	—	—	—	—	—	—	2	960	4,707
Grand Totals ..	**4,420**	**1,398,920**	**6,257,996**	**19**	**2,855**	**10,499**	**232**	**123,575**	**536,294**	**60**	**15,068**	**39,163**
Smokeless Zones (Local Acts) in Operation .. *Acres* .. *Premises* ..	44	3,400	41,060	—	—	—	—	—	—	—	—	—

The History of Air Pollution and its Control in Great Britain

852	First records of the use of coal in England.
1228	Record of "Sacoles Lane" (sea-coals) in London.
1257	Eleanor, Queen of Henry III, left Nottingham for Tutbury on account of the smoke nuisance.
1273	Use of coal prohibited in London as being "prejudicial to health".
1306	Royal Proclamation prohibiting artificers from using sea-coal in their furnaces. Record of the execution of one offender.
1307	Commission of Inquiry appointed to "inquire of all such who burnt sea-coal in the city or parts adjoining, and to punish them for the first offence with great fines and ransoms, and upon the second offence to demolish their furnaces".
1563	Scarcity of wood fuel led to an Act prohibiting the export of wood. Consequent expansion of the coal trade.
1578	Queen Elizabeth I "findeth hersealfe greatly greved and annoyed with the taste and smoke of the sea-cooles". Westminster brewers offered to burn wood because of her objection to coal smoke. Elizabeth, James I and Charles I all imposed export duties on coal.
1595	Thomas Owen brought Welsh coal and anthracite to London to demonstrate its smokelessness.
XVI century	(Elizabeth's reign). Prohibition of coal in London whilst Parliament was sitting.
1603	Sir Hugh Platt's smokeless briquettes.
1648	Petition of Londoners to Parliament to prohibit the importation of coal from Newcastle on account of the injury they experienced.
1661	John Evelyn submitted his "Fumifugium, or the Smoake of London Dissipated", to Charles II.
1700	Publication of "Campania Foelix", with a "Discourse on the Fuel of London", by Timothy Nourse,—mentioned the "stink" of coal.
Circ. **1799**	Benjamin Thompson's smokeless grates.
1801	Manchester Corporation Nuisance Committee on "Smoake".
1819	Committee appointed by Parliament to inquire how far persons using steam engines and furnaces could erect them in a manner less prejudicial to public health and comfort.
1843	A Select Committee recommended the introduction of a Bill dealing with nuisances from furnaces and steam engines.
1845	Another Select Committee reported that it was not desirable to extend the provisions of an Act beyond furnaces used for steam generation.
1845	Manchester cotton mill was observed to emit black smoke for 8 hrs. 52 mins. out of 9 hrs.
1845	Railway Clauses Consolidated Act requiring engines to consume their own smoke.
1847	The Town Improvement Clauses Act contained a section dealing with factory smoke.
1850	Manchester Smoke Inspector's Report—over 500 factory premises inspected—300 notices or cautions issued.
1853-6	Smoke Abatement Acts relating to the Metropolitan area.
1863	Alkali, etc. Works Regulation Act.
1866	The Sanitary Act empowered sanitary authorities to take action in cases of smoke nuisances.
1875	The Public Health Act containing a smoke abatement section on which legislation to the present day has been based.
1881	Formation of a Smoke Abatement Committee as a result of a movement started by the Kyrle Society and the Public Health Society.
1881	Smoke Abatement Exhibition at South Kensington organized by the Public Health and Kyrle Societies.
1882	Formation of the National Smoke Abatement Institution.
1882	Manchester Noxious Vapours Association held an exhibition.
1887	Failure of the Smoke Abatement (Metropolis) Bill in the House of Lords.
1891	The Public Health (London) Act.
1899	Formation of the Coal Smoke Abatement Society, led by Sir William Richmond, R.A., and Dr. H. A. Des Vœux (concerned mainly with London).
1903	Birmingham had four smoke inspectors.
1904	London County Council published a comprehensive report on the London smoke problem.
1905	The Government published a report on laws regarding smoke in other countries.
1905	Leeds appointed a full time smoke inspector. About this time the London Coal Smoke Abatement Society appointed smoke inspectors, but found little official support.
1906	The Alkali, etc. Works Regulation Act, which extended and consolidated previous similar Acts.
1909	Sheffield Smoke Abatement Exhibition, at which was set up the Smoke Abatement League of Great Britain (mainly for the provinces and centred later in Manchester and Glasgow).
1912	International Smoke Abatement Exhibition in London, organized by the Coal Smoke Abatement Society, leading to the formation of a Committee for the Investigation of Atmospheric Pollution.
1913	Smoke Abatement Bill introduced in the House of Commons by A. G. C. Harvey, M.P.
1914	Smoke Abatement Bill introduced in the House of Lords by Lord Newton. Withdrawn on the appointment of a Departmental Committee to investigate the problem.
1920	Committee re-formed after the war with Lord Newton as Chairman — they issued an Interim Report—dealing largely with domestic smoke.
1921	Publication of the Final Report of the Newton Committee.
1926	Public Health (Smoke Abatement) Act by which the 1875 and 1891 Acts were amended and extended.
1927	Establishment of first regional committees of local authorities.

1929	Amalgamation of the Coal Smoke Abatement Society and Smoke Abatement League of Great Britain to form the National Smoke Abatement Society. First publication of a journal (*Clean Air*) devoted to air pollution.
1935	First records of completely smokeless housing estates.
1936	Public Health Act, in which were included the provisions of the Smoke Abatement Act of 1926.
1946	Simon Report on Domestic Fuel Policy, recommending, *inter alia*, measures for domestic smoke prevention.
1946	First smokeless zone and prior approval legislation (Manchester Corporation Act).
1951	First smokeless zone established (in Coventry).
1952	Ridley Report on "Policy for the Use of Fuel and Power Resources", recommending, *inter alia*, measures for smoke prevention.
1952	London smog disaster, the most serious for many years, with a death roll of 4,000 (*q.v.*).
1953	Beaver Committee on Air Pollution was set up by the Government and published an Interim Report.
1954	Final Report of the Beaver Committee.
1954	A Clean Air Bill introduced by Gerald Nabarro, M.P., and withdrawn (4 February 1955) on Government undertaking to introduce their own Bill.
1955	Whole of City of London declared a smokeless zone.
1956	Clean Air Act.
1958	National Smoke Abatement Society became incorporated under new name of National Society for Clean Air.
1959	International Diamond Jubilee Clean Air Conference and Exhibition (N.S.C.A.), London.
1962	Smog episode in London and other cities. Estimated death roll of 750 in Greater London.
1962	Holborn M.B. first local authority in country to reach its final target under Clean Air Act.
1964	Amendments to Clean Air Act in Housing Act, 1964, modifying smoke control area policy. Clean Air Act (Northern Ireland).
1966	First Congress of the new International Union of Air Pollution Prevention Associations (in London).
1966	Alkali, etc. Works Order revoked all earlier seven Orders and consolidated them, making a few minor alterations to the lists of scheduled works and noxious or offensive gases.
1968	Clean Air Act passed.
1969	Clean Air Act brought into operation.
1970	Second Congress of the International Union of Air Pollution Prevention Associations (in Washington).
1971	The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations and the Clean Air (Emission of Grit and Dust from Furnaces) Regulations.
1971	The Alkali & C. Works Order.
1971	The Royal Commission on Environmental Pollution.
1972	U.N. Conference on the Human Environment, Stockholm.
1973	Motor Vehicles (Construction and Use) Regulations 1973
1973	Third Congress of International Union of Air Pollution Prevention Associations (in Dusseldorf).
1974	Control of Pollution Act passed and some sections brought into operation.
1974	Health and Safety at Work Act passed and some sections brought into operation.
1974	Distinction between "black" and "white" areas for smoke control abolished.
1974	Royal Commission on Environmental Pollution to undertake a study to review the efficacy of the methods of control of air pollution and to consider the relationship between the various authorities and to make recommendations.
1975	Repeal of the Alkali Act and replacement by regulations under Health and Safety at Work Act.

Major Smog Disasters

The word "smog" was first used by the late Dr. H. A. Des Vœux, founder, president of the N.S.A.S. in 1905, to denote the combination of smoke and natural fog that in urban areas may have disastrous consequences. There are numerous cases of smog conditions resulting in a marked rise in mortality and morbidity from respiratory disorders and consequential cardiac failure. Among these incidents are the following:

London, 1873. Rise in bronchitis deaths, compared with the previous week, of 268.

London, 1880. Rise in bronchitis deaths, compared with the previous week, of 692.

London, 1891. Rise in bronchitis deaths, compared with the previous week, of 572.

Glasgow, 1909. Average number of deaths in the three weeks prior to the fog were 57 per week. During five weeks of fog or haze the deaths per week were: 138, 233, 171, 198 and 137.

Manchester and Salford, 1930-31. In December, with no fog, there were 137 respiratory disease deaths. In January there were nine days heavy fog and 592 deaths.

Meuse Valley, 1930. 60 deaths attributed to fog, the death rate rising to 10·5 times the normal. Many cattle had to be slaughtered.

London, 1948. Bronchitis deaths in week before fog, 73; in the week of fog, 148.

Donora, U.S.A., 1948. 18 deaths in a population of 14,000. 42 per cent of the population were estimated to have suffered from illness.

London, 1952. The fog developed on Friday, 5 December and continued until 8 December. Estimated total of 4,000 deaths in the Greater London area. In the Administrative County only deaths from bronchitis rose from 121 to 872, and from heart and circulatory diseases, from 318 to 801.

London, 1956. 1,000 additional deaths attributed to January fog in the Greater London area. (*B.M.J.*, 31 March, 1956.)

London, 1962. Fog in London and other areas, December 3-7, with similarities to the 1952 fog, but with 750 additional deaths as compared with 4,000.

Principal References

Mortality and Morbidity during the London Fog of December, 1952. Ministry of Health Public Health Report No. 95. (This report contains a section on "Previous Fog Incidents", with a statistical appendix for those in London.)

Les Problèmes de Pollution de l'Atmosphère, Batta, Firket and Leclerc, Liége, 1937.

Air Pollution in Donora, Pa. Public Health Bulletin, No. 306, Federal Security Agency, Public Health Service, Washington.

The Clean Air Case

A Synopsis for the Guidance of Speakers, Writers, Teachers, etc.

1. Historical Background. Growth of the air pollution problem and efforts to abate it, from 852 to the present day. *(See History of Air Pollution and Its Control.)*

2. Nature, Sources and Causes.

Smoke: Due to incomplete combustion; consists of fine carbonaceous particles and tarry droplets. (For quantities produced, *see Table of Estimates of Air Pollution.)*

Gases: Sulphur dioxide the most harmful, especially when in association with smoke particles. Also carbon monoxide, and noxious gases and fumes from chemical processes. See the Society's Report on *Sulphur Dioxide as an Air Pollutant.* and *Table of Estimates of Air Pollution.)*

Grit and dust: Mainly from industrial sources, e.g., pulverized coal and highdraught furnaces.

3. Extent and Behaviour of Pollution. Measurement of floating and deposited impurities, sulphur dioxide, and of light values. The Investigation under the Warren Spring Laboratory (*q.v.*).

4. Fog. Natural and smoke fogs, their formation and characteristics. The London, 1952, 1962, and other lethal smogs.

5. Effects. *Health*: Effects on respiratory system. Effects due to obstruction of natural light. Psychological and social consequences of life in smoke-ridden environment. Effects of smog are the result of infrequent high concentration of pollution, whereas the insidious action of "normal" pollution takes place continuously.

Plant Life: Principal factors injurious to vegetation are: loss of sunlight, blocking of stomata by deposits, direct attack by chemicals, acidification of soil. Indirect effect on grazing animals through deterioration of herbage, or of poisoning in the case of fluoride pollution.

Materials: Corrosion and erosion of metals, stone, fabrics, leather, etc.

Visibility: Loss of visibility due to smoke haze and smog affecting air and surface transport.

Costs: The Cost of Air Pollution.

6. Prevention. *Industrial Smoke*: Calls for correct equipment, maintenance and operation of plant. Value of mechanical stoking. Uses of oil, gas, electricity and smokeless solid fuel. Importance of training and certification of stokers. Instrumentation, smoke alarms, etc. Need for all-round fuel efficiency. *Dust and grit*: Use of arrestors of appropriate types: cyclones, wet washing, electrostatic precipitators. *Sulphur*: removal by coal washing, flue gas-washing and other possible means. Importance of high chimneys and emission velocity.

Domestic: By use of smokeless fuels—gas, electricity, oil or solid. Need for efficient appliances. Central and district heating, whole-house warming, off-peak electrical methods, etc. Smoke control areas, purpose and national programme.

Railways and Roads: Use of diesels and electricity for the former. Need for efficient combustion and good maintenance in road vehicles. (*See also N.S.C.A. booklet "Air Pollution from Road Vehicles".)*

7. Policy, Law, etc. The present law—Clean Air Acts, 1956 and 1968, Public Health Act, 1936, local Acts, Road Traffic Act, 1930, Alkali, etc., Works Regulation Act, 1906, and Orders, etc., the Motor Vehicles (Construction and Use) Regulations 1973, the Control of Pollution Act, 1974, and the Health and Safety at Work Act, 1974. The Beaver Report and its proposals. Responsibilities of local authorities and central Government. Smokeless zones and smoke control areas. Work of the Warren Spring Laboratory, Alkali Inspectorate and other organizations. Educational and publicity work of the National Society for Clean Air. (*See Outline of the Law Relating to Air Pollution, see also the N.S.C.A. booklets "Notes on the background to Clean Air", "Towards Cleaner Air", and "Pollution", and film strip "The Air You Breathe".)*

The Cost of Air Pollution

A general enquiry into the cost of air pollution in Britain made by a sub-committee of the Beaver Committee, the findings of which were included as an appendix in the final report of the Committee in 1954 estimated the total cost at that time as some £250m a year.

In November 1972, the Programmes and Analysis Unit of the Department of Trade and Industry and the United Kingdom Atomic Energy Authority published their report "An Economic and Technical Appraisal of Air Pollution in the United Kingdom". This report quotes the direct annual cost of air pollution as some £410m. a year, the major items being:

	£m per annum
Laundry etc,	½
Window cleaning	5
Corrosion and protection of metals	42
Textiles, paper, etc.	33
Agricultural produce	195
Health	130

In addition, the report estimates that there is a "social" or disamenity cost to the country of about £780m. a year, which includes £510m. for health and £100m. for amenity.

The total cost of air pollution in the United Kingdom may therefore be said to be of the order of £1190m. a year, which represents about two per cent of the gross national product.

Expenditure on Air Pollution Control

The amount of money spent by scheduled works in capital working costs between 1958 and 1968 has been estimated from the returns submitted and is summarised in the table below. Working costs include depreciation and interest, operations, maintenance and repairs, overheads and miscellaneous.

(*From the 105th Annual Report of the Chief Alkali Inspector, 1968*)

Works	*Capital*	*Research and Development*	*10-year Working Costs*	*Latest year's Working Costs*
1. Electricity	75,731,000	856,000	126,691,000	15,300,000
2. Cement	6,216,000	301,000	6,442,000	1,000,000
3. Petroleum	6,822,000	536,000	11,667,000	1,788,000
4. Gas	2,839,000	—	4,474,000	350,000
5. Coke Ovens	2,909,000	242,000	6,126,000	710,000
6. Lime	976,000	4,000	707,000	118,000
7. Ceramics	2,090,000	163,000	3,011,000	382,000
8. Iron and Steel	26,430,000	1,235,000	93,351,000	10,364,000
9. Non-ferrous Metals	5,762,000	656,000	16,449,000	2,262,000
10. Chemical	20,527,000	952,000	55,516,000	6,782,000
TOTALS (£)	**150,302,000**	**4,945,000**	**324,434,000**	**39,056,000**

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SECTION 3

NOISE

Page

Noise and the Law 80

Noise and Noise Measurement 81

British Standards Relating to Noise 83

NOISE AND THE LAW

The Control of Pollution Act, 1974

The Control of Pollution Act, 1974 significantly extends the powers of local authorities to deal with noise problems. It makes it a statutory duty of every local authority to cause its area to be inspected from time to time to detect noise nuisances and to assess what action they should take to exercise powers conferred upon them by the Act in relation to noise abatement zones.

Local authorities, when satisfied that a noise nuisance exists within their area, or if one is likely to occur or recur, must by notice require the abatement of the nuisance or prohibit or restrict its recurrence; further they may require works to be carried out or the taking of other steps which may be necessary to fulfill the requirements of the notice. Power is also conferred on local authorities to take the same action when noise affects their area but emanates from the area of another local authority. In either case the local authority can institute proceedings in the High Court if they are of the opinion that procedings in a lower court would not afford an adequate remedy, notwithstanding that the local authority themselves have suffered no damage.

Section 59 of the act gives the right to any individual who, as the occupier of land is aggrieved of a noise nuisance, to make complaint to a magistrates' court. The court, if satisfied that the complaint is justified, is given power to make an order requiring a defendant to abate the nuisance, and if necessary to this end, to execute works. Such an order can also prohibit the recurrence of a nuisance and require the defendant to execute works which may be necessary to prevent recurrence. It should be noted here that this power of an individual to act on his own behalf in relation to noise nuisance is in a sense an extension of the power conferred on any three individuals by the Noise Abatement Act, 1960, who as occupiers of land, were aggrieved of a noise nuisance. This means that noise nuisance is no longer in a special category in this respect and that an aggrieved individual has the same rights to complain directly to a magistrates' court, as has any individual to similiarly complain, in respect of any other nuisance under the provisions of the Public Health Act, 1936.

The act also addresses itself in the problem of noise from construction sites, road and bridge works, demolition and dredging works and works of engineering construction. Where it appears to a local authority that such works are going to be carried out, they may by notice impose requirements as to the manner in which the work is effected. The type of plant to be used or plant which may not be used can be specified. Hours of work may be imposed, and maximum noise level emissions from the site can be laid down. In exercising these powers local authorities must amongst other things have regard to relevant codes of practice and give due consideration to the interests of the firm carrying out the works.

Machinery for a system of 'prior consent' to carry out any work to which the act relates is laid down in Section 61. The provisions of the Noise Abatement Act, 1960 relating to noise in streets caused by loudspeakers and sound amplifying devices such as chimes to advertise ice cream etc, are retained by the act. This means that no loudspeaker can be operated in any street between the hours of nine in the evening and eight the following morning for any purpose whatsoever and cannot be used at any time whatsoever for advertising any trade or business. (Except that perishable foods can be so advertised between the hours of noon and seven in the evening, so long as words are not used, and it is done in such a way as to not give reasonable cause for annoyance).

A very significant measure introduced is the power of local authorities to designate noise abatement zones in which noise from premises must not exceed a registered level (which is, in effect, the level measured by the local authority as emanating from the premises at a time after the area has been designated). The Act contains provisions for appeal to the Secretary of State in the case of disagreement between the local authority and the occupier of a premises as to what level should be registered. Powers are also granted to local authorities to bring about reductions in noise levels in cases where they appear to be excessive in the case of existing premises, and to control noise levels from new buildings erected in the area after its designation.

Regulations can be made by the Secretary of State for controlling noise from plant or machinery by requiring the use in connection with such machinery of devices to reduce noise, and also for limiting noise from machinery used on construction and other open air sites.

The Control of Pollution Act, 1974 repeals the Noise Abatement Act, 1960 except that notices served by a local authority to abate nuisance under Section 1 of the 1960 Act before the operation of the new act are not affected.

The Land Compensation Act 1973

As the Control of Pollution Act, 1974 has brought added powers to local authorities to control noise and thereby provide greater general protection for the public, so the Land Compensation Act, 1973 (and the Noise Insulation Regulations made under it) has made a significant step forward in providing for the compensation of people whose homes are affected by noise from new roads. Grants for carrying out works of noise insulation are payable under the act by Highway Authorities if the levels of noise outside houses are significantly raised by increased traffic due to new or altered highways. Eligibility for compensation depends on an L10 assessment which means in effect if the noise affecting the premises exceeds 68 dB(A) for more than 10 per cent of an observation period of 18 hours. If the level prior to works was above 68 dB(A) then an increase of 1dB(A) is sufficient to make for elegibility. Measuring techniques are laid down in the regulations and as with the other legislation outlined here should be consulted on points of detail.

NOISE AND NOISE MEASUREMENT

Noise has been defined in a variety of ways but perhaps the best and simplest definition is "sound unwanted by the recipient". Today it is recognised as a major environmental pollutant, responsibility for the the control of which falls mainly to local authorities.

The Decibel

The unit of noise measurement is the decibel which is a logarithmic ratio of the sound pressure created by the noise source and a sound pressure of 0·00002 N/M^2 which corresponds to the threshold of human hearing.

It can be represented thus:

$$\text{Value in decibels} = 20 \log_{10} \frac{P1}{P2}$$

Where P1 = the sound pressure given off by the noise source.

and P2 = 0·00002 N/M^2 (lowest sound pressure level detectable by the keen young human ear)

The decibel scale only takes account of sound pressure. However, there are many other factors which contribute towards the creation of annoyance on the part of the recipient. These are for instance, the time of day, any association which the noise excites, any significant impulse characteristics of the noise and most importantly the range of frequencies involved.

The human ear is sensitive only to certain frequencies. This is known as the audio frequency range and it spans from about 20Hz to 20,000Hz for young people, with the upper limit being reduced to 10,000-12,000Hz for older people. Within this range aural sensitivity is not a linear function, in that the ear is relatively insensitive to low frequency noise, but increases with pitch to a peak at around 2000-4000Hz before gradually falling away again in the higher levels of the audio frequency range. In other words the frequency of a sound contributes to the subjective impression of its volume or loudness and it is the combination of sound pressure level and frequency that is the most common basis for assessment of annoyance.

Frequency Weightings

As a result "weighting" networks have been built into sound level meters which are referred to by the symbols dB (A), dB (B), dB (C) and dB (D). They attempt to simulate electronically the subjective interpretation of noise by the recipient. The "A" weighting results in extra attenuation at low frequency, decreasing as frequency increases and at around 2000Hz "adds" to the noise. It can be regarded as an annoyance scale and of course is the scale most frequently used in general noise survey work, because it most closely correlates frequency and sound pressure (over the audio frequency range) to subjective response. The other weightings "B" and "C," which are included on most meters, correspond to equal loudness contours of 70 and 100 phons (a phon is a unit of loudness used in measuring intensity of sounds) respectively, and are not commonly used for ordinary survey work, whilst the "D" weighting is used for the assessment of noise caused by aircraft.

The Sound Level Meter

A sound level meter is basically a voltage amplifier and consists of a microphone, an amplifier, a weighting network, another amplifier and a readout device. There are several types of microphones, but the two most commonly encountered are the ceramic or crystal microphones and the more expensive condenser microphone. Both of these microphones can be used away from the meter on extension leads up to distances of about twenty feet with the ceramic type and nine feet with the condenser microphone, dependent of course on the equipment to which it is coupled. It is possible to extend the microphone from the meter to greater distances, provided a microphone pre-amplifier is used. Some models of precision sound level meters have detachable pre-amplifiers which enable the microphone to be coupled directly to this necessary amplification set many yards away from the instrument. The crystal microphone works due to Peizo-electric effect. It contains a small Peizo-electric crystal, which has the property of generating a voltage when compressed. A useful model is to imagine the crystal to be in contact with a diaphragm, which when subjected to extra air pressure due to noise, would be compressed. The voltage emanating would depend on the degree of comparison which in turn would depend upon the strength of the presure wave. With the condenser microphone the function is different. A condenser is basically two plates separated by a dielectric (air). The amount of charge held, i.e. its capacity, depends upon the distance between the two plates. If the diaphragm constitutes one plate and is subject to pressure, it will obviously bend inwards, thereby altering the capacitance of the microphone to an extent depending upon the incident wave. In both cases a varying electrical signal is picked up by the amplifiers and ultimately displayed as a readout. Neither the condenser microphone nor crystal microphone should be exposed to dampness or conditions of very high humidity and for outdoor use a wind shield should be used.

Calibration

It is essential that all equipment can be calibrated and checked very frequently. Acoustic calibrators are essential items of equipment and a number of types are readily available such as the "Pistonphone" and "Falling Ball" models. A sound level meter can, provided it has an output socket, be used to feed the noise signal being observed into a tape recorder.

Use of Tape Recorders

This system of measurement is used throughout the world and allows the recording of the noise to be subjected to later analysis of a type more detailed than can be made in the field. This technique is adopted for the accurate measurement of road traffic noise, or other noises when it is desirable to analyse them carefully into ⅓ octave or narrower frequency bands. In the latter case this can provide a great deal of useful information about the noise source, as well as acting as a guide to the appropriate remedy.

Measurement Technique

The basic equipment for this technique to be used is then:—

1 A precision sound level meter.

2 A Calibrator.

3 A high quality portable tape recorder.

This "set up" constitutes the measuring system. The technique is to (i) couple the meter to the recorder, (in this capacity the meter is acting only as a microphone), (ii) The meter is switched on and allowed to warm up for about thirty seconds. (iii) The tape recorder is switched on and set to record. (iv) A calibration signal from a piston-phone or Piezo-electric calibrator is fed into the meter and the sensitivity of the tape recorder set. (It is very important that the sensitivity of the recorder is not altered after receiving the calibration signal). (v) Having inserted the calibration signal the "set up" with the meter attenuators left on 90 dB, would record all noise from roughly about 50 dB to 100 dB (i.e. the dynamic range of the tape recorder).

If the meter attenuator was turned down to 70 dB one would pick up the range of noises from around 30 dB to 80 dB. The system is adjusted to measure the required range by setting the meter attenuators and it is important to state what attenuation is being used for the recording. As stated earlier the meter acts solely as a microphone and the needle on it is ignored. Analysis of the tape is done by using, in the case of traffic noise, a high level recorder, and a statistical distribution analyser. If narrow frequency band analysis is required, then a narrow band analyser is used in conjunction with the high speed level recorder. In most cases however, noise complaints from industrial sources can be adequately investigated with a precision sound level meter, a calibrator and an octave band filter set. Instrumentation does not enable one to assess noise nuisance more effectively, but does provide for cross-checks against recognised standards of community reaction, such as comparison with B.S. 4142 (1967), the Wilson Standards, ISO Noise Rating curves etc., and introduces an air of complete impartiality.

Noise Assessment

The procedure laid down in the British Standard could be briefly summarised as follows:—

i Set up the sound level meter 12ft 0in from the wall of the dwelling (or other reflecting object) and check the meter batteries and its accuracy using a calibrator. The microphone is pointed towards the noise source and is protected by a wind shield. The "A" weighting is utilized and the meter response is set to the **slow** response. (Sound level meters have a fast and slow function which affects the indicating needles' response.)

ii If the offending noise is temporarily absent, note the background or ambient noise level.

iii When the noise occurs one measures the Sound Level, the duration of the noise and whether it is of an impulsive nature or possesses tonal characteristics.

iv When the observations are completed one makes alterations to the measured noise level (iii above) in accordance with the standard i.e. if the noise is of an impulsive nature, or has a tonal characteristic, it is known to be more annoying and a 5 dB(a) penalty is added. Corrections are also made for Intermittency whether it occurs by day or night. The resultant figure is known as the corrected noise level, and if the difference between the background of the corrected noise level exceeds 5 db(A) one normally regards action as being necessary. The operator should refer to the standard, a copy of which is obtainable from B.S. Institution, Park Street, London. The standard also contains criteria which can be used if the background noise level cannot be established and comparison is then made between the Corrected Noise Level and the Corrected Criteria (i.e. corrected for type of district etc.,). Having ascertained that a nuisance exists one must now secure its abatement and here proper and adequate instrumentation can serve to indicate possible remedies.

Noise Insulation and Absorption

Confusion often arises between sound insulation and sound absorption. Sound absorbent materials alter the acoustic character of a room, but do not have any effect on increasing the sound insulation value. If one considers a room in an empty, unfurnished house, any noise generated sounds hollow and reverberant. Once absorbent materials are introduced, such as soft furnishings, the reflections of sound which previously caused reverberation are reduced. It follows that sound absorbent treatments basically alter the acoustic character of a room. Consider a room the wall surfaces of which are bare plaster. If a noise source were placed in this room the sound heard would be comprised of the direct noise from the source plus the reflected (reverberant) sound bounced back from the hard surfaces. There are therefore, two components making up the total noise heard. It is possible by the use of sound absorbent materials in the walls ceilings etc., to reduce the reverberant component and this has the effect of lowering the sound level within the room. The major component is now the noise emanating directly from the source and is not the summation of the two components. A reduction of more than 10 db(A) through an absorbent treatment would not be likely, although it must be remembered that the quantity of sound absorbed by any material depends on the frequency of the incident noise.

The introduction of sound absorbent material lowers the noise in the room, but does not alter the direct noise from the source, and does not significantly alter the insulation value of the structure.

If one were to enclose a noise source at present in the open with a sound absorbent material, there would be very little effective difference in the measured sound level, due to their low mass. On the other hand if one were to enclose the source with a 4½in brick wall (plastered) and cover it with a substantial roof an improvement of the order of 45 dB would result.

The average insulation value of 4½in plastered brickwork is 45 dB and the insulation value is frequency dependent. Every time the frequency of the incident sound to doubled the insulation value of the material increases by approximately 5 dB. When insulation values are quoted for different materials, they are usually the average of the time values between 100 and 3200 Hz. As a rule of the thumb the average insulation value approximates the time value at 500Hz.

Sound Absorption although a useful aid to good insulation cannot be used alone as a substitute for it.

There are several factors which determine how effective a material will be as a sound insulation. First weight—increasing the weight of a structure brings about a corresponding increase in its insulation value. e.g. if the mass of a wall is doubled from 4½in-9in the insulation value goes up by 5 dB to 50 dB. This means that by doubling the weight 5 dB has been added to the insulation value. The cellular structure of the materials is also important. To give maximum insulation the insulating material must be non-porous. Other factors of importance are the completeness or uniformity of the structure and the rigidity.

British Standards Relating to Noise

2497 Reference zero for the calibration of pure-tone audio meters 4 parts (Metric).

2750 Recommendations for field and laboratory measurement of airbourne and impact sound transmission in buildings, 1956. Metric. Amendment PD 5065, October 1963.

3048 The Relation between the sone scale of loudness and the phon scale of loudness level 1958 (Metric).

3425 Method for the measurement of noise emitted by motor vehicles 1966. Amendment PD 6024, February 1967.

3489 Sound level meters (industrial grade) 1962 (Metric).

4142 Method of rating industrial noise affecting mixed residential and industrial areas 1967 (Metric).

4196 Guide to the selection of methods of measuring noise emitted by machinery 1967. (Metric).

4197 A precision sound level meter 1967. (Metric).

4198 Method for calculating loudness 1967. (Metric).

4718 Methods of test for silencers for air distribution systems. 1971. (Metric).

4813 Method of measuring noise from machine tools excluding testing in anechoic chambers 1972. (Metric).

CP 3 Chapter III sound insulation and noise reduction.

CP 153 Part 3 1972. Sound insulation (Metric).

NOTES

SECTION 4

WATER POLLUTION

Page

Water Pollution Control in Britain 86

British Standards Relating to Water 88

Water Pollution Control in Britain

Background and the Law

For well over 100 years the control of pollution of watercourses has been a matter of concern to the British Government. With the development of modern industry and mass urbanisation early in the 19th century, coupled with the widespread introduction of the water-carriage system about the same time, rivers and streams throughout the country soon became evil-smelling open sewers and a danger to public health. Fish were killed and water made quite unfit for either domestic or industrial use. Diseases and fevers caused by water-borne organisms were rampant; for example, four epidemics of cholera in London between 1832 and 1866 were responsible for 36,000 deaths.

To improve this very unsatisfactory situation the Government in 1857 appointed the first of a series of Commissions to study the problem and explore possible remedies. Methods of treating sewage to prevent river pollution were investigated and found practicable and eventually the Rivers Pollution Prevention Act of 1876 was passed which made it an offence to discharge sewage into an inland watercourse without first making it inoffensive; similar clauses were also included to cover trade effluents. The last commission—the Royal Commission—was appointed in 1898, and during the following 17 years did an immense amount of valuable work. The reports of the various commissions have since formed the basis of the science of sewage purification throughout the world.

The Act of 1876 had placed the responsibility for prevention of river pollution in the hands of local authorities and by 1939 there were some 1600 authorities with powers for prevention of pollution. Because of this diversity of authority, the law was poorly administered and the powers were largely ineffective. There was a general movement of opinion that the river pollution law should be administered by one body responsible for the whole of a river. So it came about in 1948, by Act of Parliament, that River Boards were set up to deal with all river interests, i.e. fisheries, land drainage, navigation, conservation and abstraction of water and prevention of pollution. In England and Wales some 30 Boards were formed and these continued in existence until 1963 when under the provisions of the Water Resources Act 1963 they became River Authorities and at the same time they were given additional functions to those listed above, namely, responsibility for flood prevention and for promoting water resources. River pollution control remained with these authorities until April 1974 when the structure of the water industry in England and Wales was re-organised (see below).

The earlier River Boards continued to administer the 1876 Act, but it soon became clear that the provisions of the Act were quite inadequate for the effective control of watercourses. Accordingly in 1951 new legislation, the Rivers (Prevention of Pollution) Act 1951, came into force. This was strengthened by a further Act in 1961, the Rivers (Prevention of Pollution) Act 1961, and it is under these two Acts that discharges to non-tidal rivers, streams and connected watercourses are controlled today. In introducing these Acts for "maintaining or restoring the wholesomeness of rivers", Parliament recognised and indeed, emphasised, that this was "a process in gradualness" and one which could not be effected over the short term.

These Acts make it unlawful for anyone to make a discharge to a receiving watercourse without the consent of the controlling authority. In granting consent to a discharge, the authority may impose conditions in respect of quality and quantity which can be revised at not less than two-yearly intervals. The Acts also provide for a right of appeal to the appropriate Minister of the Crown against any conditions imposed.

Until the re-organisation of the water industry in April 1974, the responsibility for sewers, sewage treatment and disposal was in the hands of the 1200 local authorities in England and Wales. Their duties in this respect were defined under the Public Health Act 1936 which made them responsible for making "such provisions by means of sewage disposal works as may be necessary for effectually dealing with the contents of their sewers". Industrial effluents, defined as the discharge from any trade premises, may be discharged into the public sewers subject to the consent and conditions imposed by the responsible authority. These powers are allowed under the Public Health (Drainage of Trade Premises) Act 1937 strengthened by the Public Health Act 1961, which permit the authority to apply quality and quantity conditions on the trade effluents discharged. With these controls the authority is able to protect its sewerage system from substances which are harmful to man, the sewerage system, the treatment works, and hence the receiving watercourse. At the same time these Acts allow the authority to recover from traders the costs incurred for the conveyance, treatment and disposal of industrial effluents. Provision is also made for appeals to the Minister against a refusal of consent or against conditions to be imposed including charges levied.

The Regional Water Authorities, 1974

During recent years it has become evident that in order to meet the increasing requirements for water in England and Wales, a strong administrative structure would be required, which not only controlled pollution but also planned and integrated policies for the whole water cycle. The system of divided responsibility between local sewerage authorities (1200 in number), river authorities (30), together with water undertakings (160) had certain weaknesses, the main one being that their respective interests often conflicted with the best overall solution.

Accordingly, after much discussion, the Government decided to bring together under single "multi-purpose" management structures, all aspects of the hydrological cycle. Thus, under the Water Act 1973, ten Regional Water Authorities were established as from April 1974, to take over and integrate the functions of the former several statutory bodies. In addition to enforcing the pollution control legislation (referred to above), the duties of the new authorities are extended to include environmental and aesthetic considerations. Thus in carrying out their functions they are to have regard to the preservation of natural beauty, the conservation of flora and fauna and features of scientific interest, and the protection of buildings of architectural value and public rights of way. The Act recognises the amenity and recreational value of water space and requires the authorities to provide, wherever practicable, for public access to, and utilisation of, the amenity. The Act is very comprehensive and it is hoped that the Water Authorities will be able to take a perceptive and futuristic view of water resource management coupled with an increased awareness of environmental and amenity considerations.

The Control of Pollution Act is designed to consolidate the existing legislation while extending the powers for pollution prevention to cover all waters within territorial limits. Pollution sources such as disused mines and accidental discharges are also brought under control. The penalties for infringements of the regulations are increased considerably; to a maximum of two years imprisonment on conviction on indictment. It is anticipated that the new legislation and the re-organisation of the administrative authorities will result in a considerable further improvement in the quality of our inland and coastal waters, together with a responsible attitude towards water resource utilisation and conservation.

Disposal of Sewage and Liquid Wastes

Clean natural water in a watercourse is normally well-oxygenated and contains a large and varied number of life forms, including protozoa, bacteria and aquatic plants and animals, forming a complex system and keeping the stream n a healthy condition.

Pollution of a watercourse may be defined as the destroying or modifying of the life in such waters and/or the reducing of the purity of such waters so rendering them foul or filthy. Such pollution is primarily attributable to the addition of waste waters (such as sewage) which contain large quantities of suspended solid matter and oxygen-consuming organic materials. The effects on a receiving water are such that the natural dissolved-oxygen level is depressed owing to its absorption by bacteria in the presence of the organic matter. If the organic pollution load is sufficiently great, the stream may lose all its dissolved oxygen, when putrefaction, and foul odours, due the to liberation of hydrogen sulphide, ammonia, and mercaptans, result. The general overall effect is to diminish or destroy the general amenity and recreational aspects of watercourses which are the main source of supply of water for domestic and industrial purposes.

Sewage may be defined as "the liquid wastes (domestic and industrial) from a community". The object of water pollution control is to allow these liquid wastes to be carried to the sea without preventing the use of the waters into which they are discharged for the many purposes for which they are required. It is thus clear that a very wide range of interests is involved, and the effluent standard required will differ from one situation to another.

For discharges to inland rivers, streams, etc., no common standard has been fixed by statute because the character and use of rivers vary so greatly. The controlling authorities are expected to impose, and to justify, consent conditions with the particular conditions and uses of each stretch of river in mind. For example, rivers used for public water supply will in general require effluents of a greater quality than those not so used.

In 1908 the Royal Commission (referred to above) proposed a general standard for sewage effluents of no more than 30 mg/l suspended solids content and 20 mg/l biochemical oxygen demand (BOD)—a 30:20 effluent. In recommending these standards, the Commission envisaged that the effluent would be diluted with at least 8 volumes of clean river water, and that under these circumstances no problems would result. Although a 30:20 effluent is still the normal minimum requirement of river authorities for sewage effluents in the majority of situations, this is mainly because such an effluent is reasonably stable and experience has shown that such a standard can generally be achieved readily and consistently by modern methods of sewage treatment properly applied. Since the work of the Commission however, a great deal of knowledge has been gained, and continues to be gained, about the chemistry, bio-chemistry and biology of rivers and the requirements and functions of aquatic fauna and flora. It is quite plain that the condition or wholesomeness of a river does not depend on the quality of its effluent content alone, but also on such factors as gradient, depth, rate of flow, presence or absence of weirs, and the character of the river bed. They determine, together with dilution, the amount and quality of effluents that can be received without sacrificing wholesomeness. Thus in this country, individual standards for individual effluents are regarded as the modern requirement.

Conventional sewage treatment processes are thus basically designed to remove gross pollution only, i.e. oxygen-consuming (including ammonia) and sludge-forming matter. Production of a 30:20 effluent represents a removal of these constituents from sewage of between 90 and 95 per cent. This amount of purification is achieved traditionally by a two-stage process—sedimentation to remove settleable solids and biological treatment to convert dissolved and colloidal organic matter to gaseous and cellular matter. This bio-oxidation is a complex process and may be achieved by the use of either biological filters or by the activated sludge process. The cellular sludge produced in these processes is removed by further settlement for subsequent treatment and disposal; several alternative methods are employed for the treatment of sludge including digestion in the absence of air, air-drying on open beds, and mechanical drying using centrifuges, filter presses, vacuum presses, etc.

In Britain today there are some 5000 sewage treatment works employing biological processes and serving about 85 per cent of the population—a percentage very much greater than obtained in any other country. These works vary greatly in size from those dealing with a few hundred cubic metres of sewage per day to those treating over 100,000 cubic metres per day. The populations served by the two biological treatment processes, filters and activated sludge, are about the same.

On average about half the flow of sewage received at treatment works is composed of industrial effluent. In round figures this amounts each day to 6·8 mil m^3 which with some 7·3 mil m^3 of domestic sewage, makes a combined total flow of 14·1 mil m^3 or about 280 litres per person per day. It has been estimated that the volume of water used is rising at the rate of about 3 per cent per annum; the volume of sewage is consequently increasing at about the same rate.

Total expenditure on sewerage and sewage treatment currently amounts to rather more than 0·5 per cent of the gross national product, compared with a figure of about 0·4 per cent in 1961/62. In monetary terms the capital expenditure on sewerage and sewage treatment has increased from about £20 million in 1950, to £50 million in 1960, to £115 million in 1970, and to £160 million in 1973. The effect of this increased investment in recent years has resulted in a significant improvement in the overall condition of rivers in the country, despite the increasing volume of effluents discharged to them and the occurence of new problems arising, for example, from the increasing ues of new chemicals by industry and in the home.

British Standards Relating to Water

B.S.

756 Dean and Stark apparatus. Condensers and graduated receivers for determination of water content by this method. 1952 Amendment PD 1778, December 1953 (Metric).

1170 Methods for treatment of water for marine boilers, 1968.

1328 Methods of sampling water used in industry, 1969. (Metric).

1427 Routine control methods of testing water used in industry 1962. Amendments PD 5807, March 1966; PD 6063, March 1967; PD 6344 January 1968.

2455 Methods of sampling and testing boiler water deposits. 1954. Amendments PD 1967, September 1954; PD 5670, October 1965; PD 5780 February 1966.

2486 Treatment of water for land boilers. 1954.

2690 Methods of testing water used in industry
- Part 1 1964. Copper and Iron (Metric).
- Part 2 1965. Dissolved oxygen, hydrazine and sulphate (Metric).
- Part 3 1966. Silica and phosphate (Metric).
- Part 4 1967. Aluminium, calcium. magnesium and fluoride. Amendment AMD 227, March 1969 (Metric).
- Part 5 1967. Alkalinity, acidity, pH value and carbon dioxide (Metric).
- Part 6 1968. Chloride and sulphate (Metric).
- Part 7 1968. Nitrite, nitrate and ammonia (free saline and albuminoid) (Metric).
- Part 8 1968. Cyclohexylamine, morpholine and lnog-chain fatty amines (Metric).
- Part 9 1970. Appearance (colour and turbidity), odour suspended and dissolved solids and electrical conductivity. Amendment AMD 1012, August 1972 (Metric).
- Part 10 1970. Sodium, potassium and lithium (Metric).
- Part 11 1971. Anionic, cationic and non-ionic detergents and oil (Metric).
- Part 12 1972. Nickel, zinc, chromates and total chromium and manganese (Metric).
- Part 13 1972. Dichrometer value (chemical oxygen demand), non volatile organic carbon, tannin and chlorine (Metric).
- Part 14 1972. Arsenic, lead and sulphide (Metric).

3680 Methods of measurement of liquid flow in open Channels.
- Part 1 1964. Glossary of terms.
- Part 2A 1964. Dilution methods. Constant rate injection.
- Part 2C 1967. Dilution methods. Radioisotope techniques (Metric).
- Part 3 1964. Velocity area methods.
- Part 4. Weirs and flumes.
- Part 4A 1965. Thin plate weirs and venturi flumes.
- Part 4B 1969. Long base weirs (Metric).
- Part 5 1970. Slope area of estimation (Metric).
- Part 7 1971. The measurement of liquid level (stage) (Metric).
- Part 9. Water level instruments.
- Part 9A 1971. Specification for the installation and performance of pressure actuated liquid level measuring equipment (Metric).

4385 Determination of water content of petroleum products (Dean and Stark method). 1969.

CP 310 Water Supply. Amendment AMD 665, December, 1970.

SECTION 5

POLLUTION OF THE LAND

Page

Solid Wastes 90

Disposal of Industrial Wastes 91

British Standards Relating to Wastes 94

Pollution of the Land

Solid Wastes

by S. Cayton, M.B.E., C.Eng., M.Inst.F

In the eleven years between 1963 and 1974 three Working Parties produced comprehensive and authoritative Reports on Refuse Collection,[1] The Disposal of Toxic Solid Wastes[2] and Refuse Disposal[3], generally. In the same period public opinion changed from one of complete indifference, to acute awareness that frequent and regular collection and disposal of all kinds of waste is a basic necessity for a clean environment, especially in highly developed urban communities. In consequence, in 1973 the government introduced into Parliament "The Protection of the Environment Bill" or "An Act to make further provision with respect to waste disposal, water pollution, noise, atmospheric pollution and public health".

The Refuse Disposal[3] Working Party found much evidence that the recommended standards of top management which were the principles on which good "controlled" tipping had been carried out from its inception, were not being complied with. This was generally attributed to either lack of finance or suitable labour, sometimes both. Despite the short-comings of Local Authorities in this respect, Parliament proposes to continue to rely on local government, as reorganised after 1st April 1974, for the waste disposal needs of householders, commercial undertakings and industry.

The proposed legal network could be used to bring into the definition of "controlled waste" such materials as colliery and quarry spoil, which though innocuous in themselves may create obtruse conical heaps, vast scars on hillsides or extensive excavations from ground level. All seriously detrimental to the amenities of those areas, often rural in character, where these two large scale operations for the winning of minerals are carried out.

Farm waste from intensive stock rearing is liable to produce odour problems which are difficult to subdue, economically. Though these extensions of the responsibilities of the new Waste Disposal Authorities creates a formidable task, they must be taken into account in the preparation of future waste disposal plans.

In spite of a change of Government in the Spring of 1974 the strength of political and public opinion remained such that the new Government was obliged to introduce its own Bill with similar objectives, entitled "The Control of Pollution Bill". It may be questioned whether local government can be relied upon to perform better in the future than in the past; whether "reformed" necessarily follows from "re-organised" but, political and public attitudes have changed and opportunities have been created for existing plant and equipment to be used in a less parochial and restricted fashion. So, by optimum use of incinerators, for example, it is possible that large amounts of new capital will not be necessary. Improvements in tipping standards and management require a changed attitude of mind more than money though some increase in plant and trained operators will probably be needed.

The least costly form of refuse disposal is tipping to reclaim land but whether refuse is tipped "as received" or first treated by pulverisation or compressed into high-density bales, there is an ever present risk of pollution of rivers, watercourses and underground supplies of potable water due to the leaching of polluting chemicals from the refuse. Flies, rodents and offensive odours arising from burning refuse are more obvious and immediate problems.

It has been estimated that more than half the nitrates in water in the highly developed countries are washed from agricultural land by rainfall. This over-fertilisation of land leads to a considerable increase in plant growth in rivers and streams with oxygen depletion in the water, and the formation of hydrogen sulphide.

The rate of penetration of rain water through tipped refuse and the chemical changes which follow are variable and uncertain. The restrictions on tipping of ash from incinerators, crude or pre-treated refuse imposed by Water Authorities, concerned for the safety of their supplies, must be accepted by Waste Disposal Authorities but these controls must also be seen to be reasonable and have regard for the acute problems associated with the disposal of at least 50 million tonnes of refuse annually from industrial, commercial and domestic sources. This may mean stricter supervision of materials being delivered for disposal by tipping "as received" and a policy of disposal by incineration where such waste represents a hazard to underground water supplies, watercourses or rivers.

Having decided on refuse disposal by burning in an incinerator, responsible local authorities have sought by every means in their power, to prevent air pollution from their own plant. Few, if any, have succeeded. In fact, the refuse incinerator is a major polluter of the atmosphere. To improve combustion and reduce pollution, it may be necessary to introduce some form of pre-treatment of the refuse to be burned by crushing or grinding the material going to the furnace down to a bed of constant thickness.

The disposal of waste by tipping or burning will continue to be a potential source of air or water pollution. Whether it be grit and dust from the furnaces or offensive odours of tipping sites or incinerators will require constant vigilance to suppress it.

Toxic Wastes

The Deposit of Poisonous Waste Act 1972 has been largely replaced by the proposed new legislation for the control of pollution and the Waste Disposal Authorities will be concerned with the disposal of this material no less than the more normal discards from trade and industrial sources. So, the Waste Disposal Authorities and their officers will be obliged to integrate all methods of waste disposal, including reclamation of materials, where appropriate, solid or liquid, in such a way as to ensure that pollution is minimised, that is, reduced to the absolute minimum.

Radioactive Wastes

Although outside the responsibility of the Waste Disposal Authorities there are very real hazards to the environment arising from the disposal of increased quantities of radio-active waste because of the greater use of nuclear energy for the generation of electrical power. The Royal Commission on Environmental Pollution is to make an enquiry into the overall organisation for the dispersal of this waste by the Atomic Energy Commission.

The principal source is the reprocessing of the fuel elements irradiated in a reactor to generate heat. This waste contains isotopes which will remain active for very many years. The transport and storage of nuclear materials, particularly plutonium is a further matter to be investigated for it is extremely poisonous as well as being radioactive. The Royal Commission are concerned about the total hazard to the environment which must include the consequences which might follow a reactor accident. It may be that this aspect will receive overriding weight.

Offensive Odours

"The Suppression of Odours from Offensive and Selected other Trades" is being considered by a Working Party set up by the U.K. Secretary of State for the Environment in 1971. The first Part of the Working Party's Report[4] was published by Warren Spring Laboratory in 1974 and outlined the pronlems. Although the greatest number of complaints still arise from those trades which were enumerated in the Public Health Act 1875 and designated "Offensive" certain types of modern farming have produced odour problems in rural districts hitherto remote from the encroachment of industrial nuisance to mar the natural and unspoiled environment.

Between these contrasting situations are the sophisticated odours arising from the concentration of odour-producing processes which in small quantities may be stimulating, as in coffee roasting at breakfast or exciting, in the case of a droplet of perfume but when manufactured in tonnes every hour of the day odours in the vicinity of the factory are nauseating in the extreme. The problems, though widespread and of long standing have come sharply into focus because odour is a form of pollution, difficult to measure or quantify but undoubtedly deleterious to the environment. People are now very vocal and clamour for abatement of a subjective nuisance which, though not usually toxic is certainly at best, an annoyance and at worst, intolerable.

Thus it is that the National Society for Clean Air must concern itself with all forms of pollution from whatever sources, and seek to suppress them.

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[1] Refuse Collection, H.M.S.O., London 19.
[2] The Disposal of Toxic Solid Wastes, H.M.S.O., London 19.
[3] Refuse Disposal, H.M.S.O., London 1971.
[4] Odours Report Part 1, H.M.S.O., London 1974.

Disposal of Industrial Wastes

Industry produces wastes which may be liquids, sludges or solids. Some of the waste produced is already handled by established, controlled means such as the sewage treatment works and collection by local authority. It is the disposal of the remainder, most particularly that part which contains hazardous or potentially hazardous materials, which has given rise to particular concern over the last five years.

Industry disposes of some 10-20 million tons of wastes per year as compared with 14-17 million tons of domestic wastes. The table below shows the proportions of different types of industrial wastes. It can be seen that only a few per cent are indisputably toxic and, if other wastes with potentially hazardous materials are included, it is still only a relatively small proportion of the whole. These and other figures are presented in "Disposal of Solid Toxic Wastes" 1970 (HMSO) and "Refuse Disposal" 1970 (HMSO).

TABLE I
INDUSTRIAL WASTES

Type of Waste	
General factory rubbish uncontaminated by process wastes	10.4
Relatively inert process wastes	82.8
Flammable process wastes	1.1
Acid or caustic wastes	3.9
Indisputably toxic wastes	1.8

"Disposal of Solid Toxic Wastes" drew attention to the indiscriminate and uncontrolled tipping of toxic wastes to land in view of the danger of pollution of water supplies. Few cases of such pollution have been identified in the UK but this does not imply that preventative measures need not be undertaken and events reported from overseas have pointed up the potential dangers.

In 1970 the Council of Engineering Institutions and the Council of Scientific and Technological Institutes formed a Working Party (Chairman Sir Frederick Warner) which considered various aspects of environmental pollution. The memorandum which they produced was discussed with the Royal Commission for Environmental Pollution. The Royal Commission was concerned by the references made to the unsatisfactory position regarding disposal of solid wastes and subsequently looked particularly at the problems involved. As a result, in 1971, the Royal Commission encouraged the Institution of

Chemical Engineers (IChemE) and the National Association of Waste Disposal Contractors (NAWDC) to start preparing a provisional code of practice and alerted government to the need for some early legislation.

Later in 1971, there were disclosures in the press on the dumping of wastes, particularly those containing cyanides, which resulted in a climate of public opinion which favoured immediate action. Publication of "Provisional Code of Practice for Disposal of Wastes" by I.Chem.E. was expedited and timed to coincide with the passing of the Deposit of Poisonous Waste Act (April 1972) and to give practical support for that legislation.

The Code and, particularly, the Act could be said to have had an intermediate function pending future, more comprehensive, legislation and development of good practice. It has to be remembered that, at that time, there was no national policy to rationalise the use of suitable sites and to register such sites for the deposit of wastes. In the absence of such control, the Code of Practice endeavoured to set out good practice and controls which could be applied by the waste producers and the disposal companies. Although more rigorous than even the most zealous conservationalist might have hoped for, industry generally buckled down to apply the principles of the Code. For example, application of the Code was made a condition of membership by NAWDC and this covered perhaps 70% of the more awkward wastes being disposed of by contractors.

Some criticisms were made, particularly as regards the establishing of safety factors for sites where wastes might be dumped. However, the standards demanded did stimulate companies to seek expert advice, particularly from geological sciences and, indirectly therefore, the desired result was achieved.

In addition to the more formal section of the Code, the IChemE/NAWDC Working Party framed a memorandum which included points which had arisen in discussion. Many of their suggestions are covered by the provisions of the recent Control of Pollution Act (July 1974). On one point the Working Party felt quite strongly, i.e. that those concerned with the disposal of wastes should look to see what processes were available to render harmless any potentially hazardous materials and perhaps to recover some useful materials. It was recognised that, only indirectly, could legislation encourage such development.

At the time of publication of the Code, the Deposit of Poisonous Waste Act 1972 made it an offence, punishable by heavy penalties, to deposit on land any poisonous, noxious or polluting waste in circumstances which could give rise to an environmental hazard. That is to say circumstances which could cause danger to persons or animals or might pollute a water supply.

The Deposit of Poisonous Waste Act and its regulations required companies to notify local authorities of the areas where wastes originated and where they were deposited. To reduce unnecessary work, materials were listed for which no notification was required, i.e. where the materials were known to be inert or where information on quantities and qualities was already available. This notification procedure for any unlisted waste material served to identify unknown wastes of potentially hazardous content and so supplemented the information required by Dept. of the Environment for longer term controls and provision of facilities for disposal.

The longer term measures decided upon are now embodied in the Protection of the Environment Act, July 1974. This reformulates and rationalises the present procedures for collection and disposal of controlled and other categories of wastes. Controlled waste is a general term to cover household, commercial and industrial waste. The Act puts a responsibility on Waste Disposal Authorities (WDAs) to survey the wastes arising in or imported into their area, to prepare a plan to deal with them and to subsequently ensure that satisfactory arrangements are made for their disposal. The councils of counties in England, of districts and islands in Scotland and of districts in Wales are to be the WDAs.

There are provisions for licensing, e.g. for disposal sites, and the WDAs will be empowered to attach operating conditions for any such licence which they issue in connection with disposal of wastes. Although in normal circumstances the WDA would deal with all wastes coming within their area, a power is reserved for the Secretary of State to regulate the handling of disposal of the more difficult or hazardous wastes. Penalties are defined for contravention of conditions and requirements arising from the implementation of the provisions of the Act.

The new Act does, therefore, provide a frame-work within which, eventually, we should be able to develop the controlled disposal of wastes both economically and safely.

The introduction of a new animal into an environment has been known to have unforseen consequences. In the same way one might see changes in the pattern of waste disposal due to influence of the Code of Practice and legislation which are perhaps not quite in line with expectation. For example, doubts about the suitability of some sites for disposal of wastes by tipping may have led to a concentration of difficult wastes onto a relatively small number of "safe" sites. In the last three years the amount of wastes deposited on marshlands in Essex has increased from a few million to 60 million gallons per year—a veritable Torrey Canyon of waste flowing along the public highway.

The alternative of processing wastes has been pursued by the larger manufacturing companies although this is often more costly than disposal to a tip. These companies prefer to be sure and so deal with wastes locally on their own sites. The position for the companies who produce smaller amounts of potentially hazardous wastes, perhaps intermittently, is less satisfactory. (Here one might instance, at the level of the individual, disposal of used car lubricating oil).

The economics and design of a central processing plant to deal with a variety of wastes collected from different sources and containing hazardous materials require very careful attention. By integrating the processes to utilise wastes to treat wastes when possible and by recovering useful materials, one may make useful reductions in cost and so make this form of disposal more attractive. Extension of such process plants remains in the doldrums, although several disposal companies are pursuing the idea with a great deal of effort. Except for areas of high unemployment in Wales and Scotland, planning permissions for use of sites for processing wastes have been fairly consistently refused over the last three years and generally after extremely protracted negotiations. Although a variety of reasons is offered for this, one is led to the not unreasonable conclusion that waste processing plants are about as popular as prisons and power stations.

A lack of process plants sited conveniently for manufacturing industry has led to long distance haulage of difficult wastes to the few existing plants. There is always the possibility of some emergency arising, say of water pollution, which could be avoided or prevented were sufficient processing plants available to dispose of difficult wastes nearer to their point of origin. We have something of a lead in the design of waste processing plants which we could exploit if the disposal companies are not discouraged from pursuing this business.

There a is public awareness in the UK of the need for conservation and prevention of pollution and this awareness is not lacking in the elected councils through which planning decisions are made. Projects which add to local amenity or which provide employment and profit to the community have obvious attractions. Virtually all such activities produce wastes and, therefore, an important part of the decision to permit the implementation of new projects or the continuing of existing activities should properly include the means of disposal of such wastes. This can be seen most clearly perhaps in some chemical processing plants where waste treatment is often an integral part of the process—if the waste treatment plant stops then the main process must stop too.

Many technical matters require evaluation before permissions for a waste processing plant project could be given and some Councils, at least temporarily, appear to be short of expert staff who could advise them directly. (Some suitably qualified staff, previously available to them, have been taken into the new Water Authorities). There are also some problems from the inevitable hiatus caused by the creation of the larger counties from a number of small authorities. There may also be within the electorate a feeling that a waste disposal plant is a "necessary evil" but better sited in someone else's patch. In these circumstances the democratic machinery for decision making can become extremely tedious and be protracted by public enquiries, appeals, objections and so on.

The disposal Companies who are seeking consents and licences to operate process plants also lack some of the skills required. They are generally well equipped technically but less able to apply what one might call the social skills of introducing their proposals into communities who are well protected by our democratic processes. The ramifications of political thinking and machinery of decision making at local level are often unfamiliar ground to these companies. It has not been unknown for a disposal company to select a site on technical and economic grounds but to overlook that it encroached on a "green-belt" area. The profile of a process plant, often including a stack to vent the final gases, is visually objectionable to many people, however elegant it may appear to a chemical engineer. There is a need for the disposal companies to consider whether a plant can be technically correct if it does not sit well in its environment and if the community does not have a proper appreciation of the need for the plant so that sensible and objective decisions may be made.

Central government has a particularly difficult role to play in this due to the increased sensitivity at local level to imposed decisions, however beneficial they may be in the long run to the nation or indeed to the particular community itself. The Department of the Environment's policy of encouragement coupled with objective advice is not an easy one to follow but it is certainly right. With on the one hand disposal companies impatient of delays through "red tape" and on the other hand councils protecting what they see as the interests of their communities, the Department perhaps deserves more credit than it receives for the fact that at least some new process plants are to go ahead.

It may be that there is some facet of waste processing which can hold the interest of the public and provide the ambience to encourage more processing. One waste which is commonly disposed of by many individuals is used car engine lubricating oil, a waste which is potentially hazardous due to its content of carcinogens and lead. Many people believe this waste could be simply collected and burnt to provide useful heat, being quite unaware of the complicated processes involved to do so safely and economically. Perhaps a disposal company and an environmental group of a petroleum company could provide a paper to explain and propose action to cover the disposal of used engine oil and encourage interest in the establishing of a suitable processing plant? Since such a plant might be integrated to handle other wastes arising in an area, the proposal could stimulate a wider appreciation and more general acceptance of this method of disposal.

British Standards Relating to Waste

B.S.	
3316	Large incinerators for the destruction of hospital waste 1960.
3380	Wastes for sanitary appliances and overflows for baths. Part 1: 1961. Wastes (excluding skeleton sinks wastes and bath overflows). Part 2: 1962. Skeleton sink wastes.
3813	Incinerators for waste from trade and residential premises. Part 1: 1964. Capacities between 50 lb/h and 1000 lb/h.
3943	Plastics waste traps 1965. Amendments AMD 32, August 1968.
CP301	Building drainage 1971.
CP302	Small sewage treatment works 1972 (Metric).
CP302 200	Cesspools 1949. Amendment PD 2943, November 1957.
CP304	Sanitary pipework above ground 1968. Amendment AMD 187, January 1969.
CP305	Sanitary appliances 1952. Amendment PD 1847, April 1954.
CP306	The storage and on-site treatment of refuse from buildings. Part 1: 1972. Residential buildings.
CP 2005	Sewerage 1968.

SECTION 6

CONSERVATION

Page

Energy—The Crisis and After 96

Recycling for Conservation 97

Conservation of Energy and Resources

by

H. Brown, C.Eng.

Energy—The Crisis and After

Just a year ago the world was shaken by the restriction of supplies by the oil producing countries. The main effects of this action, which are still remembered, were the near-panic actions taken by domestic and industrial consumers alike to ensure supplies of heat and power, or both.

Measures to increase efficiency, which had been known for many years, were either put into practice for the first time or reinforced on an emergency basis. The results obtained in nearly all cases came as a shock—but a pleasant shock—in nearly every case.

The re-setting of automatic controls to suit actual conditions resulted in worth while savings. Staggering of lighting fittings brought savings of 50 per cent or more. Closer attention to combustion conditions allowed more heat to be obtained from the same, or even less, fuel.

The three day week imposed nationally, by restricting the use of fuel, obviously conserved stocks but, even so, it became very obvious that there was scope for improvement in plant efficiency in nearly all cases.

So far there has been little heard about the intentions of most consumers to carry out similar intensive efficiency exercises for the coming winter which, of course, could be much more severe than the one last year. Nevertheless, the prices of available fuel, particularly oil fuel, are standing at the high level of the crisis period and fuel savings can still show a worth while financial return.

During the summer we heard, from Lord Rothchild's 'think tank', that thermal insulation of structures is a worth while investment and the Minister of Energy has now introduced measures to effect savings in fuel consumption.

The techniques for increasing the efficiency of fuel utilisation are well known, but in the end it is the financial return which is the factor which governs their implementation. If it were possible to reduce the nation's overseas payments for oil fuel by 10 per cent, the result would have a marked effect upon the internal economy. To do this, however, involves all fuel users and many cannot make such savings without being involved in capital expenditure. If such expenditure cannot be justified in any given factory, office, institution or authority, then it is unlikely that the savings will be made. Due to the present price of money it is possible that expenditure will be guided to other, more lucrative areas. There would seem to be some room for scope here in terms of official encouragement.

It is, however, true that in many cases savings of much greater order for little or no expenditure can be made in many organisations and these should be considered as a vital contribution to the profitability of the undertaking as well as to the National Economy. It is often difficult, or costly, to measure efficiency values by direct means, but recourse can be taken to measuring the losses of a combustion system. The Central Electricity Generating Board is the largest consumer of fuel in this country, but by virtue of its mandate to produce the cheapest electricity available at all times, in spite of its high level of technological efficiency, from an overall thermal point of view it may also be said to be most inefficient. Little can be done to recover waste heat from existing power stations. How much better, with hindsight (an increasingly common disease) if stations had been built with facilities for using the exhaust steam from turbines for district heating and industrial heat and power purposes. The present system is too well established to be modified, but in the light of pointers from the future it is hoped that it may be found possible to amend the Board's terms of reference to allow smaller stations to be built with this facility in mind as a contribution to the national economy.

In St. Louis, USA, it has been shown that conventional grates at power stations can be fired with domestic refuse as a significant part of the fuel. This is a most interesting development which is being further funded by millions of dollars and however imperfect the system might be at present there must be lessons to be learned for similar application in the UK. The saving in capital by using suitable selected plant already in existence, together with the reduction of the need to build new refuse incineration plant must surely warrant the closest investigation.

It is not every factory which makes the best use of the heat it generates or purchases from other sources. Insulation of buildings has already been mentioned and it is a worth while exercise to determine the benefits to be obtained from this not only for new buildings but for older established structures. There are still many factories the management of which still disregard the fundamental principles of heat conservation and financial savings could be made by reviewing present practices.

Where hot water flows to the drain, heat can be recovered. Where hot air is ejected, heat can be recovered. If electric fires are needed to boost the heating standards there is something wrong with the basic system. Shortage of steam for production purposes may not be due to the boiler being too small. How many factory managers who tolerate unservicable instruments in the boiler house would allow the dashboard of their car to be filled with meaningless dials? In the life time of a car the fuel cost is approximately equal to the capital cost of the car; the fuel cost of a boiler over the life of the plant is many times greater than its capital cost. Therefore it is capable of wasting a great deal of fuel, and expenditure on adequate control measures is clearly justified.

There is, of course, the expected "growing flood" of North Sea Oil when the UK will no longer be dependant upon the overseas supplier. Taking into account the reserves of North Sea Gas this country will have a fuel availability for 20 to 30 years at the most. That is, assuming that no disruption occurs to the supply and it should be remembered that a 100 mile pipeline under one of the most treacherous seas in the world, is a very tenuous and, therefore, fragile artery. To counteract this apparent 'doomwatch' idea is the view, as put forward by Mr Micawber, that 'something will turn up'. This 'something' will only be made generally available by a consolidated and concentrated effort on the part of the best scientists and technologists backed by adequate funding on a national basis. As technology progresses it becomes increasingly more difficult and more costly to attain the next horizon.

The North Sea will therefore only give us a breathing space until the next source of energy is readily available. Until then, whilst we may have a short term commercial advantage over many other countries, we must use our available fuels to the optimum of efficiency and reduce wastage to the absolute minimum.

Recycling for Conservation

The title contains two words which are not only used very frequently at the present time, but which are often very emotive.

Recycling has, somehow, become a fashionable word to describe the salvaging of discarded materials for re-use within the industrial and domestic scene. Jumble sales of domestic discards have been held from time immemorial, and have been responsible for providing useful income for many charitable and other organisations. At the other end of the scale the 'Reubens' and 'Goyas', being of no intrinsic value, are recycled from time to time in the auction rooms of the world.

Between these two extremes lies a treasure in goods which have been discarded as useless and which, if recovered and reprocessed could provide valuable raw materials either for the industry which has discarded them or for other industries. Everyone is familiar with the salvage of waste paper carried out, either by voluntary organisations or by the Local Authority, but the efforts to recover lead from car batteries, and suitable plastics for making certain articles is not so well publicised. Other materials such as tin, copper, zinc and aluminium are received in significant quantities by disposal authorities and contractors and, at present, too little effort is made to recover these basic elements. Tin, for example, is imported to the extent of over 8,000 tons per annum, a large portion of which is used for coating 1,000,000 tons of steel to make tin plate. Much of the end product is made into the 10,000,000,000 "tin cans" which are used and then discarded in the UK. In financial terms, the tin alone is worth some £16,000,000 per annum which, after inflating our overseas expenditure, is wasted, mainly in the dustbin.

In the last few years, a number of refuse incinerators have been erected at great expense to burn municipal waste and some trade waste. The principle of direct incineration involves feeding the incinerator with all, or almost all, the waste coming to hand. The heat generated is considerable and except in one or two instances, is wasted. It is however, encouraging to note that plans are now being made in more instances for this valuable source of energy to be utilised.

The only attempt to recover valuable materials in this process has been paper salvage on a limited scale and extraction of ferrous metal after incineration.

The question must arise, therefore, as to whether we, as an island nation who must import almost all our raw materials, can afford to continue to squander our hard-earned money into the refuse dumps throughout the land without a concerted effort to recover such materials as can be re-used.

Conservation, as opposed to re-cycling, concerns the judicious and efficient use of raw materials and resources. The word 'conservationist' has, because of the extremist views of some people, come to be accepted as a term for a 'crank' determined to ensure that 'nature' takes an unhindered course for the rest of time. Man himself is not an insignificant part of the natural order of things and is entitled to his fair share of the earth's products for his well being. This does not mean that he is entitled to ride rough shod over the laws of nature, for, as Francis Bacon said, in 1601, "Nature can be conquered only by obeying her".

Here we see the connection between Conservation and Recycling, for nature herself is the greatest exponent of recycling techniques. The most ugly and apparently useless excrements play their part in producing the most useful and often the most beautiful of nature's products. Plants re-cycle carbon-dioxide into life-sustaining oxygen; nitrogen is recycled into energy giving proteins.

The only audible and visual publicity given to these processes is by thunder and lightning which itself is part of the recycling programme, and is also an untapped source of natural energy. Far too many people dismiss the idea of recycling of waste materials on the grounds of 'economics'. What they really mean is that it takes time and effort to recover raw materials from waste and this means expenditure of money. The costs of recycling compared with the true costs of production of goods from raw materials, from source to availability, is generally not known; and until such comparable costs are determined there would seem to be little point in considering only the expenditure side of the account.

In the face of all this, what right has man to squander the earth's resources without making some attempt to emulate her in order to conserve the limited wealth of elements upon which modern civilisation is based?

Editors Note: Since this article was written, the Government's Green Paper 'War on Waste' has been published and contains an expanded summary of the position in respect of recovery of valuable materials from refuse.

SECTION 7

CURRENT RESEARCH PROGRAMMES

Current Government and Government Supported Research in Air Pollution in Great Britain 1974 99

The University of Leeds 107

The Warren Spring Laboratory.. 108

The Central Electricity Generating Board 109

NIFES 110

The Medical Research Council's Air Pollution Unit 111

E.P.E.M.A. 113

The Atomic Energy Research Establishment 113

Current Government and Government Supported Research in Air Pollution in Great Britian 1974

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This Index contains a brief summary of research projects on environmental problems started or in progress between July 1972 *and December* 1973 *and which are being undertaken in Great Britain either at Government institutes or with direct Government fundings at other centres. It includes projects in hand at Research Association laboratories which are paid wholly or in part by Government funds specifically allocated to these projects. It does not include projects financed solely out of Research Association general funds or items of research funded solely by nationalised industries, private industry or universities.*

Where practicable, figures on the number of graduates and equivalent staff employed on projects are given, as is information on the duration of projects. It will be appreciated that these details are no more than estimates.

	Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
1.1	**Surveillance**				
1.	Agricultural Development and Advisory Service Regional Laboratory, Aberystwith; Pwllpeiran Experimental Husbandry Farm	MAFF	Monitoring of trace elements in rain	—	1975
2.	Agricultural Development and Advisory Service Regional Laboratory, Cambridge; Boxworth Experimental Husbandry Farm	MAFF	Monitoring of trace elements in rain	—	1975
3.	Agricultural Development and Advisory Service Regional Laboratory, Leeds; Great House Experimental Husbandry Farm	MAFF	Monitoring of trace elements of rain	—	1975
4.	Agricultural Development and Advisory Service Regional Laboratory, Reading; Efford Experimental Horticultural Station; Lee Valley Experimental Horticultural Station	MAFF	Monitoring of trace elements in rain	—	1975
5.	Agricultural Development and Advisory Service Regional Laboratory, Wolverhampton; Drayton Experimental Husbandry Farm	MAFF	Monitoring of trace elements in rain	—	1975
6.	Animal Virus Reseach Institute	ARC	Generation, survival and dispersal of infective aerosols	2·5	Continuing
7.	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	DOE	Electron microscopy of aerosol particles	—	1976
8.	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	MOD	Fog studies	1	1976
9.	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	DOE MOD	Life cycle of sulphur compounds in the atmosphere	5	1976
10.	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	DOE	Oxides of nitrogen	0·7	1976
11.	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	DOE	Photochemical smog	1·5	1976
12.	Bristol University	DOI	Investigation into infra-red analysis of atmospheric pollution in the stratosphere	—	1974

	Institution	*Department responsible*	*Specific Investigation*	*Graduate equivalent staff employed*	*Estimated completion date*
13.	British Antarctic Survey; Scott Polar Institute	NERC/DES	Investigation of Antarctic ice cores to give historical evidence of airborne substances	—	Indefinite
14.	British Glass Industry Research Association	DOI	Sampling and analysis of waste gases and particulate emissions from glass furnaces	2	Indefinite
15.	British Non-Ferrous Metals Research Association	DOE	Air pollution from copper smelters	—	1974
16.	Chemical Defence Establishment	MOD	Sampling and identification of unusual pollutants	—	Indefinite
17.	Exeter University, Department of Chemistry	MRC/DES	Isolation of aromatic hydrocarbons from petroleum	1	1974
18.	Fire Research Station	DOE	Combustion products of plastics	4	Indefinite
19.	Fire Research Station	DOE	Special investigation of dust explosions in industrial plant	2	Indefinite
20.	Freshwater Fisheries Laboratory, Pitlochry	DAFS	Acid content in rain	1	1974
21.	Freshwater Fisheries Laboratory, Pitlochry	DAFS	Organochlorine residues in rain	1	1974
22.	Government Chemist's Laboratory	DOI	Pollutants in air and rain	—	Indefinite
23.	Liverpool University, Department of Oceanography	NERC	Significance of chlorinated hydrocarbons in the natural environment	—	1974
24.	London University, Chelsea College, Department of Applied Biology	NERC	Survey of relative burdens of atmospherically borne metals in Britain	—	1974
25.	London University, Imperial College of Science and Technology, Department of Mechanical Engineering	SRC/DES	Analysis of engine exhaust emission with a view to developing low pollution engines	1	1974
26.	London University, Imperial College of Science and Technology, Department of Public Health	DOE/TRRL	The identification of the malodorous components in street air arising from vehicle emissions	1	1973
27.	London University, Imperial College of Science and Technology, Department of Civil Engineering	SRC	Studies in air and water pollution	—	1973
28.	London University, Queen Mary College, Department of Mechanical Engineering	SRC/DES	Carbon formation in burning diesel sprays	2	1974
29.	London University, Queen Mary College, Industrial Materials Research Unit	DOE	Smoke formation during the burning of plastic materials	3·5	1974
30.	Manchester University, Simon Engineering Laboratories	SRC/DES	Investigation of pollutant formation in spark ignition engines	—	1973
31.	Meteorological Office	MOD	Measurements of pollutants in air and in rain and the role of the atmospheric aerosol in the formation of precipitation	3·5	Indefinite
32.	Meteorological Office	MOD	Study of sulphur budget over the British Isles	0·5	1975
33.	Microbiological Research Establishment	MOD	Studies of bactericidal properties of pollutants in urban areas with reference to recognition of the presence of olefinozone reaction products	—	Indefinite

	Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
34.	Nottingham University, Department of Mechanical Engineering	SRC/DES	Soot formation in gas turbine combustion chambers	1	1973
35.	Oxford University, Department of Physical Chemistry	SRC	Photochemical reactivity with particular reference to excited species of atmospheric interest	5	1973
36.	Ricardo and Co. Engineers (1972) Ltd., Vehicle Engineering Division	DOE	Diesel exhaust odour	1·16	1975
37.	Rothamsted Experimental Station	ARC	Nature and behaviour of air-borne fungal spores arising from agricultural materials (Farmer's Lung)	1·5	Continuing
38.	Safety in Mines Research Establishment	DOI	Investigation of the mixing of fluid streams of different densities	3	Indefinite
39.	Transport and Road Research Laboratory	DOE	The measurement of atmospheric pollutants arising from vehicles in an urban area	1·5	Indefinite
40.	Transport and Road Research Laboratory	DOE	The measurement of organic lead in certain areas	1·5	1973
41.	Transport and Road Research Laboratory	DOE	The measurement of particulate lead on and near a heavily trafficked motorway	1·5	1973
42.	Transport and Road Research Laboratory; Aston University, Department of Chemistry; in co-operation with Birmingham City Corporation	DOE	Monitoring pollutants arising from traffic around the Gravelly Hill Interchange, Birmingham	2	1974
43.	Transport and Road Research Laboratory, Warren Spring Laboratory	DOE	Monitoring the long-term trends in air pollution in urban areas arising from vehicle emissions	2	1977
44.	University of Wales; University College of Swansea, Department of Botany	NERC/DES	Survey of relative burdens of atmospherically borne metals in Britain	—	1974
45.	Warren Spring Laboratory	DOE	Assessment of the nature and quantity of noxious emissions from domestic refuse incinerators	—	Continuing
46.	Warren Spring Laboratory	DOE	Automobile air pollution monitoring networks	0·5	Continuing
47.	Warren Spring Laboratory	DOE	Characterisation of suspended particulates	—	Continuing
48.	Warren Spring Laboratory	DOE	Extension of UK national air pollution surveillance by central and local governments (heavy metals, sulphur in particulates etc.)	3·0	Continuing
49.	Warren Spring Laboratory	DOE	Five-cities studies of pollution from road traffic	2·5	Continuing
50.	Warren Spring Laboratory	DOE SDD	Fluoride emission monitoring	0·25	Continuing
51.	Warren Spring Laboratory	DOI	Measurement of smoke and sulphur dioxide in air in remote areas	0·1	Continuing
52.	Warren Spring Laboratory	SDD	Monitoring of industrial emissions of grit and dust	1·0	Continuing
53.	Warren Spring Laboratory	DOI	Relationship between meteorological conditions and air pollution	—	Continuing

Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
54. Warren Spring Laboratory	DOI	Study of air pollution in London	0·5	Continuing
55. Warren Spring Laboratory	DOI	Study of airborne and deposited lead around lead works	0·5	Continuing
56. Warren Spring Laboratory	DOI	Study of downwash from domestic chimneys	—	Continuing
57. Warren Spring Laboratory	DOI (in co-operation with OECD)	Study of long-range transport, dispersion, transformation of sulphur dioxide in the atmosphere, both airborne and ground level measurements	2·2	1975/6
58. Warren Spring Laboratory	DOE	Study of SO_2 and smoke distribution in the UK for assessment of economic implications of control	—	Continuing
59. Warren Spring Laboratory	DOE	Survey of airborne metal levels in vicinity of metallurgical industry in the Midlands	0·5	Continuing
60. Warren Spring Laboratory, in co-operation with local authorities, the Central Electricity Generating Board and others	DOE	The National Survey of Smoke and Sulphur Dioxide	4·2	Indefinite
1.2 Effects on man				
61. Atomic Energy Research Establishment, Environmental and Medical Sciences Division	DOI NRPB	Inhalation studies: factors affecting the deposition and clearance of particulate material in the human respiratory tract using tracer techniques	2·5	Indefinite
62. Atomic Energy Research Establishment, Environmental and Medical Sciences Division	DOI	Asbestos: a study of its structure, respirability and behaviour in biological systems using tracer methods	0·7	Indefinite
63. Cardiothoracic Institute, Department of of Medicine	MRC/DES	Immunopathogenesis of human lung disease due to inhaled organic and inorganic dusts	1	—
64. Department of Employment, Employment Medical Advisory Service	DE	Carbon disulphide: cardiovascular disease	—	Indefinite
65. Department of Employment, Employment Medical Advisory Service	DE	Di-amino-diphengl methane (DADPM) at risk register	—	Indefinite
66. Department of Employment, Employment Medical Advisory Service	DE	Health of chrome-platers	—	Indefinite
67. Department of Employment, Employment Medical Advisory Service	DE	Health of drop forgers	—	Indefinite
68. Department of Employment, Employment Medical Advisory Service	DE	Phthalic anhydride: respiratory disease and skin sensitization in manufacture	—	Indefinite
69. Department of Employment, Employment Medical Advisory Control	DE	Respiratory disease in antimony workers	—	Indefinite
70. Department of Employment, Employment Medical Advisory Service	DE	Respiratory disease in cotton workers	—	Indefinite
71. Department of Employment, Employment Medical Advisory Service	DE	Respiratory disease of malt workers in Scotland	—	Continuing
72. Department of Employment, Employment Medical Advisory Service	DE	Scouring powder manufacture: a radiological study	—	Indefinite

	Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
73.	Department of Employment, Employment Medical Advisory Service	DE	Sensitization to dusts containing derivatives of B. subtilis	—	Indefinite
74.	Department of Employment, Employment Medical Advisory Service	DE	Tungsten carbide grinding: hard metal disease	—	Indefinite
75.	Department of Health and Social Security, Public Health Laboratory Service Board	DHSS	Laboratory investigations farmer's lung	2 + 1 technician	1977
76.	Essex University, Department of Chemistry	MRC/DES	Inhalation of aerosols by man	1	1974
77.	Essex University, Department of Chemistry; MRC External Scientific Staff	MRC/DES	Inhalation of aerosols	1	Indefinite
78.	Kings College Hospital Medical School, Department of Medicine, Chest Unit	MRC/DES	Biochemical and pharmacological effects on long function with special reference to asthma	2	1978
79.	Medical Research Council, Air Pollution Unit	MRC	Effects of air pollution in the growth and morphology of respiratory pathogens	—	Continuing
80.	Medical Research Council, Air Pollution Unit	MRC/DES	Effects of emissions from motor vehicles	—	Indefinite
81.	Medical Research Council, Air Pollution Unit	MRC/DES	Effects of pollutants on pulmonary function	—	Indefinite
82.	Medical Research Council, Air Pollution Unit	MRC/DES	Lung cancer mortality in relation to urban factors	—	Indefinite
83.	Medical Research Council, Air Pollution Unit	MRC/DES	Theoretical study of the lungs and pneumatic systems	—	Indefinite
84.	Medical Research Council, Air Pollution Unit	MRC/DES	Trends in pollution and health in London	—	Indefinite
85.	Medical Research Council, Pneumoconiosis Unit	MRC/DES	Effects of exposure to asbestos	—	Indefinite
86.	Medical Research Council, Pneumoconiosis Unit	MRC/DES	Effects of physical, chemical and biological properties of fibres	—	Indefinite
87.	Medical Research Council, Pneumoconiosis Unit	MRC/DES	Farmer's lung and related diseases	—	Indefinite
88.	Medical Research Council, Pneumoconiosis Unit	MRC/DES	Lung function; interrelation of functional changes and development of tests suitable for detecting early changes due to occupational and environmental factors	—	Indefinite
89.	North Lonsdale Hospital, Barrow-in-Furness, Pathology Department	MRC/DES	The pleural changes occurring in a population potentially exposed to asbestos	1	1974
90.	Reading University, Department of Chemistry	MRC/DES	Modification of the effects of asbestos and related dusts in tissues	1	1973
91.	Reading University, Department of Chemistry	MRC/DES	Therapeutic or prophylactic substances for treatment of asbestosis	2	1974
92.	Royal Postgraduate Medical School, Department of Medicine	MRC/DES	Action of drugs on the lung (including aerosols)	1	1976
93.	St. George's Hospital Medical School, Department of Physiology	MRC/DES	Experimental diseases of the respiratory tract and lungs	2	1978
94.	Wales, University of, University College, Cardiff, Department of Mineral Exploitation	MRC/DES	Physical and chemical characteristics of airborne mineral particles contained in diseased tissues	1	1974

	Institution	*Department responsible*	*Specific Investigation*	*Graduate equivalent staff employed*	*Estimated completion date*
1.3	**Effects other than on man**				
95.	Atomic Energy Research Division Environmental and Medical Sciences Division	DOE	Lead uptake	0·5	1976
96.	Building Research Establishment	DOE	Effects of air pollution as a factor in the durability of building materials	2·2	1975
97.	Central Veterinary Laboratory	MAFF	Fluorosis in farm animals	Less than 1	Indefinite
98.	Forestry Commission, Northern Research Station	FC	Growth of trees in the Pennines in relation to air pollution	1 part time	Indefinite
99.	Forestry Commission, Northern Research Station	FC	Investigation of tree growth around aluminium smelters at Invergordon and Fort William	1 part time	Indefinite
100.	Lee Valley Experimental Horticultural Station	MAFF	Effect of air pollution on plant growth in glasshouses	Less than 1	Indefinite
101.	London University, Bedford College, Department of Botany	SRC/DES	The effects of sulphur dioxide on metabolism of lichens	1	1974
102.	London University , Imperial College of Science and Technology, Department of Botany and Plant Technology	NERC	Effects of sulphur dioxide on some native British tree species	—	1974
103.	Macaulay Institute for Soil Research	ARC	Contamination of soils and plants growing thereon, by atmospheric deposition or the application of by-products with high heavy metal contents	0·3	Continuing
104.	Manchester University, Department of Zoology	NERC	Industrial melanism in the Manchester area	2	1976
105.	Medical Research Council, Pneumoconiosis Unit	MRC/DES	Dust, protein and other analyses of animals' lung and tissue cultures	—	Indefinite
106.	Meteorological Office	MOD	Studies of the effects of SST (supersonic transport) flying on the characteristics of the stratosphere and on the climate of the earth.	6·5	1975
107.	Rothamsted Experimental Station	ARC/DES	Influence of sulphur dioxide and fluorine compounds on plant growth and loss of crop yield	2	1975
108.	Rowett Research Institute	ARC/DAFS	Adverse effect of heavy metals upon the metabolism of essential trace elements in animals	6	1975
109.	St. George's Hospital Medical School, Histopathology Department, London	MRC/DES	Experimental chronic bronchitis: the effect of varying SO2 exposure regimes on goblet cell population of rat bronchi	1	1974
110.	Wales, University of, Institute of Science and Technology, Department of Applied Biology	NERC	The effect of atmospheric pollutants upon plant growth under experimental conditions (a feasibility study)	—	1974
1.4	**Modelling studies**				
111.	London University, Imperial College of Science and Technology, Department of Mathematics	SRC/DES	Case studies and modelling in air pollution	1	1973
112.	Warren Spring Laboratory	DOI	Development of mathematical modelling techniques for air pollution distribution	1·5	Indefinite
113.	Warren Spring Laboratory	SDD	Predictive model of air pollution in Upper Forth estuary for planning purposes	—	Indefinite

	Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
1.5	**Control**				
114.	British Glass Industry Research Association	DOI	Improvement of methods of founding glass and reduction of air pollution	1·2	1974
115.	British Hydromechanics Research Association	DOI	Load tests on chimney top device to prevent downwash	—	1973
116.	British Hydromechanics Research Association	DOI	Vortex chimney	—	1975
117.	Building Research Establishment	DOE	Development of glass fibre reinforced cement and glass fibre reinforced gypsum with their substitution for asbestos as a secondary objective	3	1975
118.	Chemical Defence Establishment	MOD	Development of new absorbents	—	—
119.	Chemical Defence Establishment	MOD	Filtration mechanisms and test methods for the assessment of filter efficiency against vapours and airborne particles	—	—
120.	Government Chemist's Laboratory	DOI	Determination of fume and dust emissions	—	Indefinite
121.	Great House Experimental Farm	MAFF	Husbandry practices to alleviate effects of air pollution	Less than 1	Indefinite
122.	London University, Imperial College of Science and Technology, Department of Mechanical Engineering	SRC	Analysis of engine exhaust emission with a view to developing low pollution engine	1	1974
123.	Manchester University	DOI	Abatement of pollution by direct methods	—	1975
124.	Meteorological Office	MOD	Study of atmospheric turbulence and convection in first few thousand feet above ground	10·5	Indefinite
125.	Military Vehicles and Engineering Establishment	MOD	Reduction of exhaust gas emission	—	—
126.	Motor Industry Research Association, Vehicle Engineering Division	DOE	Vehicle air pollution—In service checks	—	1974
127.	Motor Industry Research Association; Transport and Road Research Laboratory; Warren Spring Laboratory	DOI DOE DOI	Evaluation and study of lead filtration devices for petrol fuelled vehicles	—	Continuing through 1974
128.	National Engineering Laboratory	DOI	Combination of a steam powered prime mover and hydrostatic transmission unit to exploit the inherent low pollutant characteristics of the external combustion unit	1·2	1973
129.	National Gas Turbine Establishment	MOD	Production and consumption of pollutants from rich hydrocarbon/air flames	—	Indefinite
130.	National Physical Laboratory	DOI	Particulate pollution from car exhausts	0·5	1973
131.	National Physical Laboratory	DOI	Ships' funnels and industrial chimneys: wind tunnel	1	Indefinite
132.	Torry Research Station	MAFF	Reduction of air, water and noise pollution from fish handling and processing plant	2	Indefinite
133.	Warren Spring Laboratory	DOI	Aerodynamic pollution distribution problems relating to chimneys and buildings	2·1	Indefinite
134.	Warren Spring Laboratory	DOI	Air pollution abatement relating to process emissions	—	Continuing

	Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
135.	Warren Spring Laboratory	DOI	Authorisation of smokeless fuels and appliances	—	Continuing
136.	Warren Spring Laboratory	DOI	Correlation of wind tunnel modelling with full-scale phenomena	1·1	1973
137.	Warren Spring Laboratory	DOI	Development and evaluation techniques for the estimation of industrial process effluents to allow assessment of abatement plant	—	Continuing
138.	Warren Spring Laboratory	DOI	Identification of grit and dust deposits	0·1	Indefinite
139.	Warren Spring Laboratory	DOE	Motor vehicle air pollution abatement using catalytic methods	1·2	Indefinite
140.	Warren Spring Laboratory	DOE	Motor vehicle exhaust catalysts	1·2	Continuing
1.6	**Methods of measurement**				
141.	British Non-Ferrous Metals Research Association	DOI	Improved sampling and monitoring equipment	0·1	Indefinite
142.	Chemical Defence Establishment	MOD(PE)	The measurement of toxic hazards from combustion products in fires	1	Indefinite
143.	Department of Employment, Employment Medical Advisory Service	DE	Micro methods of estimating blood lead	—	Indefinite
144.	Department of the Environment Mechanical Engineering Division	DOE	Diesel smoke test procedures and assessment of smoke meter	0·5	1973
145.	Government Chemist's Laboratory	DOI	Development of simple, rapid methods for determination of toxic substances in industrial atmospheres	—	Indefinite
146.	London University, Imperial College of Science, and Technology, Department of Chemical Engineering	SRC/DES	The development of a laser camera system for automatic particle size analysis	1	1973
147.	Medical Research Council, Air Pollution Unit	MRC/DES	Development of analytical techniques for determination of physical and chemical characteristics of pollutants	—	Continuing
148.	Medical Research Council Pneumoconiosis Unit	MRC/DES	Assistance in developing and testing an international classification of the radiographic appearances of pneumoconiosis; development of statistical methods of analysis to permit its use as one of the measures of biological response to dust	—	Indefinite
149.	Motor Industry Research Association	DOI	Measurement of smoke from diesel engined vehicles	—	1973
150.	National Gas Turbine Establishment	MOD	Rapid sampling and analysis of aero gas turbine combustion products	—	—
151.	National Physical Laboratory	DOI	Precise measurement of ultraviolet radiation which may have application for detection of atmospheric contaminants	1	1974
152.	Paint Research Association	DOI	Analytical methods for monitoring gaseous effluent from industrial storing finishing plants	3	1974

	Institution	*Department responsible*	*Specific Investigation*	*Graduate and equivalent staff employed*	*Estimated completion date*
153.	Pest Infestation Control Laboratory	MAFF	Methods of measuring, controlling and standardising output of insecticide vapour slow-release units	0·1	Indefinite
154.	Safety in Mines Research Establishment	DOI	Development of instruments and sampling techniques for measurement of respirable dust	4	1975
155.	Safety in Mines Research Establishment	DOI	Development of instruments and sampling techniques for pollutant gases (eg methane, monoxide and oxides of nitrogen) in mines and other working environments	7	1975
156.	Sira Institute (British Scientific Instrument Research Association)	DOI	Evaluation and calibration of instrumentation for measurement of pollutant gases	1·5	Continuing
157.	Sira Institute (British Scientific Instrument Research Association)	DOI	Instrumentation for monitoring airborne pollution	1	Continuing
158.	Sira Institute (British Scientific Instrument Research Association)	DOI	Performance assessment of instrumentation for measuring concentration of dissolved gases and pollutants	1	Continuing
159.	Wales, University of, University College of Swansea, Department of Civil Engineering	SRC	Computed methods in thermo-fluids and solid mechanics Particular emphasis on environmental pollutants	1	1976
160.	Warren Spring Laboratory	DOE	Problems of measurement, assessment and abatement of vehicle emissions		
161.	Warren Spring Laboratory	DOE	Study of deposit gauge performances and deposition	0·1	Continuing
162.	Warren Spring Laboratory	DOE	Study of methods of measuring air pollutants for the designation international standard methods	—	Continuing
163.	Warren Spring Laboratory	DOE	UK deposit gauge survey	0·1	Continuing

Research Undertaken by the Department of Fuel and Combustion Science, The University of Leeds

Air Pollution resulting from Combustion

(i) Studies of the formation of NOx in methane and oil flames.
(Professor A. Williams).

(ii) Studies of Urban Visibility.
(Professor A. Williams, Dr. A. G. Clarke and Dr. W. A. Gray).

Study of Dispersion of Chimney Gases in order to Minimise Pollution by correct Design and Siting of Chimneys.

Mathematical modelling of high and low level emissions.
(Dr. M. T. Jacques).

Distribution of Pollution in Urban Areas, etc.

Analysis of pollution trends in the City of Leeds, measurements of NOx, SO_2, smoke and photochemical oxidants; kerbside monitoring of vehicle emissions; urban models of pollution.
(Professor A. Williams, Dr. M. T. Jacques, in conjunction with the Local Authority).

Combustion—generated noise

Studies of noise resulting from combustion processes.

Water pollution caused by Petroleum Products

Studies of the dispersion and reactions of hydrocarbons in water.

The Warren Spring Laboratory of the Department of Industry

The two main areas of investigation by the Air Pollution Division at Warren Spring Laboratory are the measurement of air pollution and techniques for the control and reduction of air pollution levels. The programmes are mainly carried out in relation to the interests and responsibilities of the Department of the Environment and Local Authorities. Specific problems are tackled on a repayment basis for Local Authorities, industry etc. Other Divisions at WSL are involved in the air pollution programmes as part of a wide range of environmental research covering oil pollution and scrap and waste treatment.

The National Survey of Air Pollution

Warren Spring Laboratory has been responsible for the national surveillance of smoke and sulphur dioxide (and to a lesser extent grit and dust) on behalf of successive Government Departments administering clean air legislation. The Laboratory co-ordinates and standardises the voluntary efforts of Local Authorities and other bodies contributing to the National Survey and it centrally collates, disseminates and analyses the data produced.

There are now, spring 1974, 469 Authorities making daily smoke or SO_2 observations at 1170 sites. The survey is primarily of urban air pollution; only about 10% of the sites are in rural areas. In addition, monthly measurements of grit- and dust-fall are made with the British Standard Deposit Gauge by 175 Authorities at 556 sites. Monthly measurements are still made at 235 sites of the extent of reaction of sulphur compounds in the atmosphere with a standard lead dioxide surface. The Laboratory gives help and advice on all aspects of these co-operative investigations. In particular advice is given on the selection of sites.

The Annual Tables of air pollution measurements prepared by the Laboratory can be purchased by anyone concerned with air pollution problems. For smoke and sulphur dioxide, these Tables give, for each site and for each month of the year, the average concentration, the highest daily concentration and the number of days for which the concentration exceeded certain values: 250, 500 $\mu g/m^3$ etc. The seasonal and annual average figures are also given. For grit and dust-fall and for the lead dioxide observations the data for each month and the seasonal and annual averages are given.

A series of Reports has been prepared dealing with the National Survey of Air Pollution 1961-71. The four volumes of Reports covering the twelve statistical Regions of the United Kingdom are published by HM Stationery Office price £3·50 each. The Reports provide a critical breakdown of the data by size of conurbation, site type, season, etc, showing the general trends of improvement in air pollution, but also highlighting those towns where concentrations were still undesirably high.

All Local Authorities and other organisations making measurements of air pollution which are published by Warren Spring Laboratory are entitled to send representatives to the Standard Conference of Co-operating Bodies organised by the Laboratory. Other bodies may do so on payment of a subscription. This Conference meets twice yearly to discuss relevant air pollution matters. Just before Local Government reorganisation 425 bodies had appointed representatives to the Conference.

The Laboratory is now exploring the possibility of harmonising the monitoring efforts of the new Local Authorities and other bodies for pollutants other than those covered by the National Survey. The first stage is to assess Local Authorities' current monitoring activities and future intentions. It is too early to say what co-ordination can be introduced.

Other Surveys

For the Department of the Environment the Laboratory undertakes on a less than nationwide basis, surveys of emissions and ambient concentrations of industrial, vehicular and other pollutants. Short studies are also commissioned on repayment by Local Authorities.

Roadside Pollution—Five Towns Survey

Following its reassuring 1960's survey of carbon monoxide levels for over a year in six cities, Warren Spring Laboratory started in 1972 the monitoring of a number of pollutants in the busiest streets of five towns in the United Kingdom—London, Cardiff, Glasgow, Cambridge and Birmingham—for a period of five years. Levels of carbon monoxide, total hydrocarbons, lead and smoke, together with traffic density and meteorological data are measured at all sites. In addition, at two sites in London, one at the roadside and the other a background station, nitric oxide, nitrogen dioxide, gaseous sulphur compounds and ozone are continuously measured. The data are reduced and analysed off line at WSL by computer.

As before, the approach is to concentrate on situations in which the vehicle flow and street ventilation conditions are likely to lead to the highest levels of pollution. It is possible to register trends in pollution levels produced by varying traffic load, etc, or as a result of legislation on engine design, exhaust systems or fuel.

Measurements in London have shown the frequency with which significant photochemical reactions can occur during a good summer, and have contributed to the general knowledge of atmospheric chemistry in this country. The results are of value to medical researchers, and will be one of the bases for deciding on the possible need for further legislation.

Heavy Metals

Since 1972 the Laboratory has co-ordinated dust and soil sampling and analysis around a number of works operating both scheduled and unscheduled processes involving lead.

In the Midlands it has been carrying out a survey of airborne metals in the vicinity of a number of metallurgical plants. The DOE Monitoring Report, issued in 1974, assigned to the Laboratory the task of conducting an exploratory multielement survey (including heavy metals) at twenty sites in urban areas throughout the UK.

Other Extensions of Air Pollution Surveillance

Also proposed in the Monitoring Report were the daily measurement of sulphate in suspended particulates at twenty urban sites and the deployment of three sets of instruments for measuring ozone, oxides of nitrogen and hydrocarbons additional to those used in the 5 Towns Survey. Also in hand is a wind tunnel assessment of deposit gauge performance which will show what different gauges are capable of collecting.

Pollution Abatement

Odours from Offensive Trades

During 1971 the Department of the Environment set up the Working Party on Odours from Offensive and Other Trades under the Chairmanship of Dr Valentin, Deputy Director of Warren Spring Laboratory. The Working Party, which produced its first report in 1973 has examined the major odour-producing industries, assessing the effectiveness of existing odour abatement techniques and looking, where necessary, for more successful practices. Warren Spring Laboratory has provided the Working Party with detailed technical support. The Working Party's final report should be published in 1975 but, already, the Department of the Environment has accepted a recommendation that further research should be carried out on the problems of assessing odours and their abatement by various techniques. A substantial programme, initially for three years, has been commissioned at Warren Spring Laboratory, in expectation that the programme will also attract both industry and Local Authority support.

Vehicle Pollution

The large scale lead filter project for the Department of the Environment was completed in 1974 and further work on vehicle pollution abatement and test techniques are in hand. The facilities include a static engine test rig and a roller dynamometer with extensive analytical and control equipment. The Catalysis Section at WSL is investigating catalysts to improve exhaust gas composition; the work includes evaluation of exhaust composition, its variation with mode of vehicle operation, and its significance in relation to selection of catalysts for abatement purposes.

Air Pollution Control Through Planning

Without actual reduction of pollutant emissions it is possible to minimise their effects by careful siting by the use of appropriate chimneys, etc. Work in this field at WSL includes advice on chimney heights where the situation is more complex than can be covered by the Chimney Height Memorandum. For even more complex built-up areas emission distributions are physically modelled in one or two wind tunnels. Studies include flats, offices and hospitals as well as industrial installations and the positioning of vehicle exhausts. For larger areas, particularly for development planning purposes, the Laboratory applies mathematical models to relate pollution levels and weather data to the detailed pattern of emissions. With these models it is possible to predict the effect of new developments on pollution levels. The Upper Forth Estuary Study for the Scottish Development Department is the main project of this type.

International Transport of Air Pollutants

The first phase of the OECD study of the Long Range Transport of Air Pollution has confirmed that a proportion of sulphur dioxide or its transformation products can be transported distances up to 1000 km or more and that for periods some areas receive more deposited sulphur pollution than can be accounted for by local emissions. WSL is organising the UK contribution to the network ground level measuring sites in this OECD study now in its second, more intensive phase. The Laboratory has also conducted measurements of the flux of sulphur compounds across the North Sea.

Measurement and Instrumentation

Part of the Air Pollution Division's effort has to be devoted to keeping abreast of developments in instrumentation for air pollution measurement and to the harmonisation of monitoring methods internationally. The main organisations with which the Laboratory is working are UNEP, WHO, OECD, EEC and ISO (representing BSI). Currently there is great emphasis on international exchange of environmental information.

The Central Electricity Generating Board

The main sources of air pollution from the operations of the Generating Board are the products of combustion of coal and oil. These are considered under the headings of: separation of solids from gases; dust measurement; disposal of solids; dispersion of gases.

Separation of Solids from Gases

Both the older and more modern pulverised fuel plants rely on electrostatic precipitation as the final or only stage of separation of particulate matter from flue gases. A research programme has revealed unexpected deficiencies in gas distribution, in rapping and in power supplies in some older plants. As soon as this research can be applied to individual plants, the deficiencies are being made good. Poor gas distribution leads to reduced efficiency because the greater efficiency of dust removal in a starved channel does not fully compensate for the reduced efficiency in an overloaded one; when, by means of velocity measurements and model techniques, the gas flow has been analysed, baffles can be designed and inserted to smooth the flow. Rapping impulses by means of which the collected dust is removed from the precipitator electrodes, have been found by actual measurement with accelerometers to be much attenuated if transferred from one member, such as a holding frame, to another, such as the plate or wire itself. Research on optimum electrical sub-division of the precipitator has shown the need for maintaining maximum power supply to each section and the importance of correct electrode spacing to reduce flashover.

Statistical analysis of the results of efficiency tests has shown the relative contribution to efficiency of such factors as size of precipitator, degree of sub-division, specific collecting area, power input, and the characteristics of the ash and the coal. It is clear that too low a sulphur content impairs collecting efficiency by making the particles electrically non-conducting, but no simple practical means of increasing the effective sulphur content of the ash from low-sulphur coals has been developed for routine application.

Dust Measurement

An important part of a dust-arresting installation is some means of informing the operator of any failure to function correctly. The pollution by dust at ground level is caused in the main by particles in the range from 20μm upwards, and an instrument has therefore been developed known as the CERL Dust Monitor which gives a continuous record of the emission of these coarser particles which are not recorded by instruments used to measure the emission of smoke. The CERL Dust Monitor has recently been redesigned.

The Mark II instrument is now commercially available, it has given a very reliable performance in Power Stations and is being tried out in other industries, including cement and iron works.

The nuisance from excessive emissions is a function of total output over a period of time, and integrators for the sum of the readings of all instruments in a power station over an eight-hour shift period are available.

The Mk. II instrument does not purport to deal with the very fine ash and black smoke particles which have a size less than 20 micrometers. These particles are, however, objectionable because of their appearance in the atmosphere. Smoke meters (sometimes referred to as opacimeters) are mainly influenced by the finest particles and provided they are designed with sufficient zero stability and sufficient sensitivity can give a valuable guide to the emission of fine dust and black smoke. An instrument which can be inserted from one side of a duct and removed for a manual check of zero has been developed, and is commercially available. An instrument with an automatic zero check has been developed and is under test.

Because it was thought that the standard deposit gauge had a limited application to modern dust problems, a new type of gauge has been developed for measuring dust in the field known as CERL Directional Dust Gauge. This has been used in routine measurements around a number of modern power stations and its directional characteristics are considered to be of considerable assistance in the interpretation of measured results. Its design has been modified to make it as cheap as possible to produce, and it is now covered by British Standard specification 1747 part 5 1972.

The conversion of smoke recording instrument reading to Ringelmann number has now been set out in an addendum to British Standard 2742 1969—addendum No. 1 1972.

Ash Disposal

Local air pollution can arise where dust which is handled or dumped is allowed to dry. Economical techniques of surface treatment are under investigation. There is a particular problem with cenospheres (floaters) on ash lagoons. These can dry on the surface layer and be picked up by the wind. A number of methods for dealing with this difficulty are now being investigated, from immobilising them *in situ* to harvesting them for industrial use.

Dispersion of Gases

Eight-port daily SO_2 samples are used routinely around power station sites for a number of years before and after commissioning of the stations. In addition a number of stations have been intensively instrumented using in each case about two dozen continuously recording SO_2 instruments and full meteorological instrumentation. The SO_2 recorders were developed about 10 years ago at CERL and have been successfully used in these surveys. The surveys have given excellent support to theoretical predictions and to the effectiveness of tall chimneys in controlling large-scale emissions of flue gas, as well as providing new knowledge on the particular influence of inversion layers above and below the chimney top. One important aspect of chimney height is now seen to lie in the proportion of inversions which are penetrated by the flue gases.

The Tilbury and West Burton investigations have been concluded. A further survey of this type is nearing completion at Eggborough which is the first 2000MW power station employing a single chimney. This survey has 25 SO_2 recorders and meteorological measurements which for the first time give details of atmospheric conditions up to 1,250 feet from the surface of the Earth. The use of a laser to measure the height of a plume, even though it is invisible to the eye, has been developed for some years at the Tilbury survey. This will continue to be used at Eggborough and its use will also be developed to study the temperature profile of the atmosphere in the range immediately above 1,250 feet. Observations of plume rise and ground level SO_2 concentration will also be made in due course at the Drax power station in Yorkshire, which has a single 850ft chimney designed for 4000MW of generating plant. Gas turbine plumes have also been studied.

Other Potential Problems

In recent years prominence has been given to claims by certain European countries that SO_2 emissions several hundred miles from their sources can adversely affect forests, agriculture and rivers by producing "acid rain". It has been widely acknowledged that insufficient scientific data are yet available to confirm or deny these claims and an international study of long-distance drift of SO_2 has been started under the auspices of OECD. The Generating Board is participating in the UK contribution to this work and in addition is making further studies of some relevant factors; such as the chemical reactions of SO_2 at low ambient concentrations and the rates of absorption of SO_2 at the surface of the earth. In a related field the extent to which low concentrations of atmospheric SO_2 may assist in meeting the essential sulphur requirements of growing plants is also under consideration.

The National Industrial Fuel Efficiency Service Ltd.

NIFES provides a complete advisory service on energy utilisation and conservation and associated pollution problems. Comprehensive advice and assistance are available, ranging from brief visits by experienced engineers to fully instrumented surveys which show by precise measurement how systems can be operated efficiently at minimum cost. Problems in connection with the Clean Air Act, noise abatement, water pollution and conservation, and measurements of grit and dust emission are all dealt with. Ten offices provide a comprehensive coverage of Britain, and work is also being carried out in Europe.

Training courses for boiler operators and all personnel concerned with fuel and energy applications are arranged by request and there are regular residential courses on all aspects of fuel firing.

A full consultancy service is provided for the design and specification of new plant and services, including all types of refuse disposal equipment. A comprehensive commissioning and testing service is also available.

The Medical Research Council's Air Pollution Unit

The following notes describe briefly the current work on air pollution being done by the M.R.C. at St. Bartholomew's Hospital Medical College. For convenience the work is described in outline under various headings but it will be realised that the method of presentation does not mean that the topics are being investigated in isolation. The various investigations are highly integrated and it should be stressed that there is excellent liaison between the M.R.C. Air Pollution Unit, other M.R.C. units and outside bodies. The Unit has been designated as the World Health Organisation International Reference Centre on Clinical and Epidemiological Aspects of Air Pollution.

Chemical and Physical Nature of Pollutants

As a prerequisite to the proper study of the effects of pollution much work is still being done on the chemical and physical nature of pollutants and methods for their determination.

The changing relationship between black pollution and concentration of pollution in terms of mass is being investigated, and the efficiencies of several types of filter media have been determined with the collection of very fine airborne material in mind.

With the reduced amount of black pollution the measurement of reflectance from soiled filters has become more difficult. An extremely sensitive A.C. reflectometer has been constructed, which, when used with the specially developed sampling head readily gives reading of reflectance of the faintest stains. This instrument can be used to give readings for very low concentrations of some gaseous pollutants.

Studies on Carcinogens

Our interest in 3:4-benzpyrene and other polycyclic hydrocarbons is declining since their concentrations are decreasing and there is little evidence now that these compounds as urban air pollutants are associated with lung cancer. Some studies on the stability of these hydrocarbons have shown that some of them appear to be destroyed by ultraviolet light and nitrogen dioxide. Investigation into the sources of polycyclics has shown that the relative proportion of certain hydrocarbons can vary; using a ratio of coronene to 1:2-benzpyrene (two stable hydrocarbons) it has been possible by analysing samples of collected smoke to identify sources of hydrocarbons such as coal fires and motor vehicles. A study into the production of hydrocarbons from burning fuels has shown that the above hydrocarbon ratio increases markedly as the combustion efficiency increases.

Acid Particles

Acid particles, which may be of clinical significance, are very common in town air. Their source at times of low pollution appears to be the efficient combustion of fuels; past records show that at times of high pollution synthesis of acid takes place and that high concentrations of sulphur dioxide and smoke occurring together are important for the formation of much particulate acid.

Lead

Much work is being done on airborne lead from various sources. Trends in concentration, at different sites, of particulate and gaseous lead compounds are being assessed at various sites and their solubilities in various body fluids are being studied. Measurements of blood lead are being made in selected population groups in relation to exposure of lead from traffic sources and the wider range of lead sources in the environment.

Electron Microscopy

Work is continuing on the depiction and identification of particulate pollutants by electron microscopy and electron diffraction, special attention being paid to asbestos and lead.

The site of deposition and degree of retention of particles in the respiratory tract depend on many factors among which are size and shape. Much work is being done on the electron microscopic appearance of particles in engine exhausts under different engine operational conditions and to relate these appearances to those particles found in streets and motorways. Special attention is being paid to the distribution of lead in particles with special reference to its biological availability.

Physics of the Lung and Measurement of its Function

The fundamental study of the lung as a physical system is enabling us to reassess the methods of measuring its function in health and disease. In the past, studies to determine the physiological effects of environmental pollutants have been hampered by the lack of a very sensitive test to assess the effects of respiratory insult, and as part of the search for a more refined technique, we are developing new methods of assessing respiratory function. The analysis of continuous respiratory waveforms is being studied using the unit's own on-line digital computer to process the physiological data.

The breathing signal is monitored with a simple strain gauge sensitive to changes in thoracic or abdominal circumference. Basic characteristics of each breath contained within a record of this signal are measured and the data are presented in graphical form on a visual display unit. The simple displays and mathematical transformations of them are used for comparing records of normal breathing obtained from human subjects before and after exposure to realistic concentrations of the common bronchospasm producing air pollutants. A model of this purely pneumatic aspect of the respiratory system is being developed.

Studies of Acute Effects of Inhalation of Pollutants

Very many combinations of gases and aerosols of different composition have been inhaled in order to study their effects on pulmonary function. Some of the healthy volunteer subjects have been shown to respond to realistic concentrations of sulphur dioxide in the laboratory, following forced respiratory manoeuvres.

At the beginning of a long series of daily measurements of airway resistance following exercise in the prevailing pollution in central London some correlation with pollution was found, and further results are being studied carefully.

Daily measurements of ventilatory function have been made for a five-year period on healthy volunteers, but no consistent relation with pollution has been found. However, there is some evidence of transient effects in periods of high pollution, particularly after exercise. From an extension of this study, a correlation has been found for one individual between the change in peak flow on entering London each morning and pollution. Some evidence of changes in peak flow in relation to pollution has also been obtained from long series of measurements on bronchitic patients.

Currently the effect on human subjects of gases and aerosols which may be found in the ambient air are being reassessed, using new tests of pulmonary function relating especially to possible changes in small airways.

Carbon Monoxide

Because of the many sources of carbon monoxide, its varying concentrations in air, and the fact that its absorption depends on exercise and time, the measurement of carboxyhaemoglobin is greatly to be preferred to measurement of CO in air. The simpler indirect methods of measuring carboxyhaemoglobin such as the measurement of alveolar air are being tested; this involves simply analysing carbon monoxide in exhaled air after breath-holding.

Following the development of a micro-method for determining CO in blood, surveys of blood levels have been made in people exposed occupationally or experimentally to traffic. These have shown, so far, that levels above 4% saturation with carboxy-haemoglobin are rarely attained in non-smokers but levels higher than this (not uncommonly greater than 10%) are frequent in smokers. These surveys are being extended.

Experimental work is being done on the possible effects of carbon monoxide, producing a saturation of up to 10%, on the performance of fine tasks and on vigilance. So far, the results have shown no perceptible effects of such saturations on flicker and flutter fusion thresholds. These experiments have been extended so that the possible effects of diluted whole petrol and diesel exhausts on delicate tests of perception and performances can be examined. The effects have been demonstrated.

Pathology

We are perfecting a technique for assessing lungs received from operations or autopsies which will indicate the effects pollution has had on the large airways, the small airways, and the respiratory part of the lung, and the distribution of inhaled pigment. We are now looking at specimens from rural, urban and industrial populations, considering smokers and non-smokers separately.

We are also studying the three dimensional anatomy of the respiratory part of the lung and that of lung tumours, together with the pollution history (domicile, occupation, respiratory diseases, smoking) of the patients from whom specimens have been removed surgically. The technical problems of preparing such lungs for quantitative assessment are also being tackled. The relevance of this fundamental work to the genesis of disease in relation to air pollution is obvious.

Bacteriology, Effects of Pollutants on Lung Flora

It has been suggested that pollution in town air is responsible for the greater prevalence of chronic bronchitis in towns compared with country districts. As part of our investigations into the possible relationship between air pollution and bronchitis we have been studying the effects (in vitro) of particulate pollutants collected from London air on the growth of some organisms found in the respiratory tract—Strep, viridans and Staph. aureus—and those commonly recovered from the sputum of patients with chronic bronchitis—Strep. pneumoniac and H. influenzae.

Epidemiology

Trends in pollution in London are still being followed carefully: since the 1950's the average concentration of smoke has fallen by about 80%, and that of sulphur dioxide by about 50%, although there is now little further change from year-to-year. The most interesting feature as far as acute effects on health are concerned has been the virtual disappearance of episodes of high pollution, and by now it seems likely that this is a real change brought about at least partly by the removal of the "blanket" of smoke over London, that at one time prevented the sun from breaking up temperature inversions.

Studies of day-to-day changes in the condition of bronchitic patients are continuing. These have already shown a marked reduction in acute effects of pollution following the implementation of the Clean Air Act, and current results are being related to a wider range of environmental variables.

Now that there is no longer any clear evidence of sudden increases in hospital admissions or deaths in London in relation to pollution, more detailed studies are being undertaken in which these morbidity and mortality data are being analysed by cause and by age to see whether the effects of influenza epidemics, pollution, cold spells and other environmental factors either interact or are cumulative. Tabulations of daily deaths have now been obtained for other parts of the country, so that these studies can be extended to areas where the reduction in smoke concentrations has not been as great as in London.

The role of pollution as a contributory factor in the development of chronic bronchitis is being investigated in a number of ways. There are encouraging signs from the trends in bronchitis mortality that reductions in pollution may be having a beneficial effect, initially in London, but extending gradually to other urban areas. To separate effects of pollution from those of other relevant factors (notably smoking) it is however necessary to conduct special surveys. In a study in London, early symptoms of respiratory disease among 18-year-olds were examined, comparing in particular a group born just before the fog of December 1952 with one born just after it. The results indicate that this single episode had no dominant effect, but further studies are planned to assess whether continued exposure to high levels of pollution during childhood had adverse effects on the group as a whole. New spirometric techniques have been developed to allow a much wider range of ventilatory measurements to be made in future surveys. A longitudinal study of a group of medical students first seen at age 19 is being continued, and detailed pulmonary function studies have now been made on them for the third time. "Cross-sectional" studies of peak flow are also being made among office workers in the City of London, linking the results with smoking habits and area of residence.

Studies of lung cancer mortality now show that the rise in death rates among men is gradually drawing to a halt, whilst the rates for women are still increasing. The general trends are related to changes in smoking habits, but signs of a reduction in male death rates are appearing in London, sooner than in other parts of the country, and it is possible that reductions in pollution are playing some part in this.

The Environmental Protection Equipment Manufacturers' Association

EPEMA was inaugurated at a meeting held in September 1972 under the auspices of the National Society for Clean Air.

For some considerable time it had been felt by some members of the Society and by manufacturers of equipment for the abatement of pollution, that there should be some form of association of such manufacturers which could represent their views and have close links with the Society. After a series of talks and negotiations, it was felt in September 1972, that the time was right for a start to be made. Accordingly, the Association was launched and in the 18 months of its existence, with some administrative help from the Society, it is now beginning to grow and has some 15 members.

EPEMA is a non-profit making Association financed entirely by the subscriptions from its members. It consists of manufacturers and installers of equipment designed to reduce and/or monitor pollution emitted to the environment; one of its main aims is, through its members, to seek to improve the standards of all equipment for the abatement and monitoring of pollution. To enable it to do this, the Association negotiates with appropriate government departments and through them with the E.E.C. The Association ensures that its members manufacture, market and install equipment of the required standard. In other words, the Association is endeavouring to provide protection for the consumer. In addition, the Association provides advisory service not only to its members but also to customers regarding supply, provision, installation and operation of a suitable pollution control and measuring or monitoring equipment; obviously, it is not in a position to act for such customers in a consultant capacity.

EPEMA is a member of the National Society for Clean Air; it is recognised as a national body and has as its representative on the Council of the Society, Mr. K. S. Dunn of the Incinerator Company Limited. The Association is also represented on the Society's Technical Committee by its Chairman, Mr. Max Beaumont of F. E. Beaumont Limited.

Further information may be obtained from EPEMA, at 136 North Street, Brighton BN1 1RG.

The Atomic Energy Research Establishment

The Harwell atmospheric pollution programme is concerned with (a) the physical and chemical characteristics of pollutants and (b) pollutant life-cycles and reactions in the atmosphere. The principal areas of interest at present are the life cycle and long distance transport of sulphur compounds in the atmosphere, photochemical oxidants and their effects, nitrogen oxide chemistry, and lead aerosols in petrol engine exhaust. Two projects, one on the oxidation of sulphur dioxide in ambient air containing hydrocarbons and nitrogen oxides, and the other on the dry deposition of sulphur dioxide, form the UK contribution to the COST project.

In addition, there is an environmental analysis project whose main objectives are: (a) to determine the atmospheric concentrations and origins of trace elements and their rates of deposition to vegetation and soil and (b) to assess the importance of atmospheric deposition of trace elements into the sea from the atmosphere.

In the field of radioactivity, measurements have been made since 1953 of fallout from nuclear test explosions in air and rainwater to give early indications of changes in the levels of fallout which affect levels of dietary contamination.

Work is in progress in which radioactive non-leachable mono-disperse particles are administered to human volunteer subjects to measure the uptake and clearance of particles of various sizes from the lungs; to study the effects of different breathing patterns and the uptake, localisation and clearance of particles from the nose.

Studies are also carried out on the solubility of asbestos *in vivo* and the use of induced radioactivity to investigate the fate of inhaled and ingested asbestos fibres.

The progress of work on these topics is published in the annual report of the Environmental and Medical Sciences Division.

LIFE CYCLE OF SULPHUR COMPOUNDS IN THE ATMOSPHERE

Long range transport of sulphur dioxide and sulphates

It is claimed that rain in Scandinavia has become more acid in recent years because of sulphur compounds emitted in the UK and other countries of Western Europe and transported to Scandinavia.

Knowing the amount of sulphur dioxide emitted in the UK, the amount transported to Scandinavia or other countries can be determined either by measuring the flux of sulphur dioxide and sulphates across the North Sea, or by measuring the amount deposited in the UK. The OECD Study on long-range transport of sulphur dioxide, in which other laboratories in the UK are taking part, attempts to answer these questions by measurement of sulphur deposited in rain and sulphur dioxide concentrations at ground level. In complementary Harwell investigations the dry deposition of sulphur dioxide (omitted in the OECD study) is being measured, and aircraft sampling is being used in conjunction with the Meteorological Office to determine the flux of sulphur dioxide across the North Sea.

Dry deposition of sulphur dioxide on vegetation is measured by the gradient method and by radioactive tracers. The first method is based on the fact that if a gas is absorbed at the ground surface there is an associated gradient of concentration with height. The flux of gas to the ground can be estimated if its concentration in air and also the wind speed are measured at two or more heights. Measurements have been made over grassland, ploughed soil and over a forest canopy. In the second method, sulphur dioxide labelled with radioactive sulphur-35 is released over natural grassland and its deposition velocity derived from measurements of the atmospheric concentration and the flux to the surface. The effective mixing depth of sulphur dioxide over grassland has been measured by sampling at a number of heights using a tethered balloon. From this value and the rate of emission of sulphur dioxide in the UK, the mean stay time can be calculated and another estimate of the fraction deposited obtained.

In addition, as part of the COST programme on the physico-chemical behaviour of sulphur dioxide in the atmosphere the deposition velocity of sulphur dioxide has been measured over a reservoir. The results indicate a moderate surface resistance in contrast to the theoretical result of Liss that the surface resistance of natural water bodies should be negligible.

Oxidation of sulphur dioxide in the atmosphere

Despite much previous work on this topic, a full and quantitative understanding of oxidation rates in the atmophere has yet to be obtained. During 1974, significant progress has been made on two mechanisms which operate in the gaseous phase, i.e. cloud, rain or fog droplets. A marked synergistic effect between trace amounts of manganese and iron in rainwater acting to catalyse the oxidation has been discovered which will enhance oxidation rates in more polluted atmospheres. In less polluted areas, away from major sources, oxidation by atmospheric ozone in solution, the importance of which was first recognised in the Harwell studies, has been placed on a firmer theoretical basis and well established as the dominant mechanism in solution (see later for a discussion of photochemical oxidation).

Natural sulphur cycle

In order to understand the impact on the environment of man's sulphur emissions to the atmosphere, it is necessary to know the nature and extent of the natural sulphur cycle, a subject about which surprisingly little is known at present. A series of experiments on the rates of emission of volatile sulphur compounds (sulphur dioxide, hydrogen sulphide, mercaptans, dimethyl sulphide) from different soil samples is being undertaken together with a study of the rate of incorporation of sulphur into the organic soil fraction, both using sulphur-35 as tracer.

ATMOSPHERIC PHOTOCHEMISTRY

Photochemical smog

The programme of ground level ozone measurements, as an indication of photochemical smog, previously undertaken at Harwell was enlarged during 1973 to include a remote site at Adrigole, Co. Cork, Eire. Although intended as a background site, the data surprisingly showed elevated ozone levels similar to those observed at Harwell during periods of photochemical activity. Consideration of air mass trajections and measurement of Freon 11 (CCl_3F) which is entirely of anthropogenic origin, left no doubt that these high ozone incidents were associated with advection of polluted air to southern Eire, not only from the UK but also from continental Europe.

Apart from ozone another important product of photochemical smog is PAN (peroxyacetyl nitrate) which is partly responsible for eye-irritation effects and the first measurements in the UK were made at Harwell in the autumn of 1973. The concentrations were substantially below the levels observed in Los Angeles. PAN may be a better indicator of photochemical smog intensity than ozone and automatic PAN analysers have been developed and installed at Harwell and London. The oxides of nitrogen are also analysed on a continuous basis. Nitrous acid, nitric acid, total aldehydes, formaldehyde and hydrocarbons are analysed on an occasional basis.

In parallel with these atmospheric measurements a programme of laboratory experiments has been undertaken to improve the understanding of the complex reactions involved in the photochemical process. Free radical reactions, especially those involving hydroxyl (OH) and hydroperoxyl (HO_2) radicals and their interconversion, are particularly important. The primary attack on hydrocarbon molecules is made by OH radicals and a method of producing substantial OH concentrations under ambient conditions by the photolysis of nitrous acid (HNO_2) has been developed, which has enabled measurements of reaction rates with hydrocarbons and other molecules to be made. Such chemical rate data is being applied in a computer model of the photochemical process. The model allows for non steady state conditions, diurnal variations of all solar photolysis rates and physical processes such as aerosol scavenging and dry deposition, not previously introduced into such models.

Both OH and HO_2 radicals have the important capability of oxidising sulphur dioxide to sulphuric acid and measurements of the rate constants for the reactions of the OH and HO_2 radicals have been made using the nitrous acid system. The reactions turn out to be of importance both in unpolluted and polluted air. A more detailed study of the photochemical oxidation in polluted air has been made as part of the COST programme and excellent correlation between sulphuric acid formation and both ozone production and NO to NO_2 conversion has been demonstrated. The results of this and earlier work at Harwell have done much to establish the importance of this mechanism for oxidation of sulphur dioxide in the atmosphere. Oxidation rates for other sulphur species of possible importance in the natural sulphur cycle, e.g. hydrogen sulphide, methyl mercaptan, and dimethyl sulphide, have also been determined.

LEAD

A large fraction of the lead in the atmosphere is derived from the us eof tetra-ethyl lead in petrol. The lead is emitted from the exhaust systems of petrol engined vehicles as small particles, which can enter the body by inhalation or can deposit on crops which are consumed by grazing animals. A technique has been developed for the preparation of tetra-ethyl lead labelled with radioactive lead. This has been added to lead-free petrol and used in a petrol engine to produce exhaust containing particles labelled with radioactive lead. These particles are used in wind tunnel studies on deposition on grass and in inhalation studies with human volunteers. Electron microscope techniques are also used to try to identify the lead compounds present in the particles.

A theoretical paper on the travel and deposition of lead aerosols has been issued. This treats the lead emission from a moving vehicle as a line source. Theoretical calculations of the lead in air at various distances from roads with given traffic density appear to be in good agreement with published data.

TRACE ELEMENTS IN AIR AND RAINWATER

Trace elements in the atmosphere can be considered as (a) nutrients, (b) potentially toxic pollutants, and (c) as tracers of transfer mechanisms. The background levels of trace elements and the natural and unnautral variations about these levels are being measured to observe the passage of trace elements through the environment. Harwell carry out a national project to measure and interpret the levels of some 30 stable elements in rainfall and airborne dust at seven stations in non-urban areas. A similar programme is carried out at coastal stations surrounding the North Sea in order to estimate the deposition of trace elements into the sea from the atmosphere. More intensive environmental programmes are carried out for Local Authorities. A logical extension of these atmospheric investigations now being considered, is to measure the deposition (and uptake) of trace elements on to soil and vegetation. In addition, an intensive environmental programme has been completed in the Swansea area.

FALLOUT

Rainwater is collected at eight stations in the UK and at 20 stations elsewhere from Tromso (70°N) in Norway to Halley Bay (76°S) in Antarctica. Airborne dust is sampled at ground level at five sites in the UK and at four sites overseas. The radioactivity in the samples is mainly measured by gamma-ray spectrometry and analysed by computer. These measurements provide an inventory of the radioactivity from nuclear test explosions and give early indications of changes in the levels of fallout which affect levels of dietary contamination. The interpretation of the data also provides information relevant to the world-wide transport of pollutants generally.

INHALATION STUDIES

The primary objective of this programme is the acquisition of basic information on the deposition of inhaled particles in, and the clearance of deposited material from the human respiratory tract. Systematic studies have been made of the effect of particle size and flow-rate on the deposition of radioactively labelled spherical particles of unit density in the nasal passages of volunteers. The clearance of particles deposited on both the ciliated and non-ciliated regions of the nasal mucosa have also been studied. Rather similar techniques have been used to demonstrate impairment of nasal mucociliary clearance in woodworkers in the furniture industry. Currently, experiments are being carried out to study the effect of particle size and breathing pattern on deposition in the tracheobronchial and pulmonary regions of the human respiratory tract.

ASBESTOS

Work is in progress to study the fate of inhaled asbestos particles of various sizes, shape and chemical composition in order to determine more precisely the quantities and sites of initial deposition, changes within the body and later retention. Inhalation experiments, using rats, have been carried out with the standard reference samples of asbestos which have been made radioactive. The radioactivity enables the initial pattern of deposition in the various regions of the respiratory and gastro-intestinal tracts to be determined. Autoradiographic techniques enable individual fibres to be located in thin lung sections, and show the distribution of fibre in whole lung sections.

SECTION 8

GUIDE TO PUBLICATIONS

Page

Recent Acquisitions to the NSCA Library 117

Films and Filmstrips 119

Guide to Publications 127

Recent Acquisitions to the NSCA Library

All available on loan to members

BOOKS

Air Pollution and Atmospheric Diffusion. Beryland, M. E., Editor. John Wiley & Sons.

Air Pollution Abstracts Index 14081-20048. U.S. Environmental Protection Agency.

Air Pollution Engineering Manual, second edition. Danielson, J. A. U.S. Environmental Protection Agency. 1973.

Air Pollution Translations: Volume 5. A Bibliography with Abstracts. February 1974. U.S. Environmental Protection Agency.

Air Quality Abstracts. 800 pages. Pollution Abstracts, Inc.

The Atmospheric Environment of Cities and Larger Areas. Frisken, W. R. The Johns Hopkins University Press. March 1974. £1.70.

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Carbon Monoxide, Origin, Measurement and Air Quality Criteria. Verein Deutscher Ingenieure.

Chemical Engineering in Practice. Nonhebel, G. Wykeham Publications Ltd. 180 pages, £2.25.

Chemistry of the Lower Atmosphere. Rasool, S. I. Plenum Press. 330 pages. 1973. £11.90.

Compilation of Air Pollutant Emission Factors, second edition. U.S. Environmental Protection Agency.

In Defence of Economic Growth. Beckerman, Wilfred. Jonathan Cape Ltd. 1974. 287 pages. £3.95.

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Extraction of Minerals and Energy: Today's Dilemmas. Paul A. Deju. September 1974. £13.00.

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Lead and Air Pollution: A Bibliography with Abstracts. U.S. Environmental Protection Agency. 1974.

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The New Threshold. 1973. The Club of Rome.

Noise Abatement. Duerden, C. Butterworths. 1970.

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Physiological Effects of Noise. Welch, Bruce L., and Welch, Annemarie S. (Ed.). Plenum Press, London and New York. £10.35.

Pollution—Engineering and Scientific Solutions. Edited by Barrakette, E. S. Plenum Press.

The Steel Industry and the Environment. Szekely, J., Editor. Marcel Dekker, Inc. New York, 1973.

Understanding and Controlling Air Pollution, 2nd Edition, by Howard Hesketh. John Wiley & Son.

PAPERS, REPORTS, PAMPHLETS ANNUAL REPORTS

110th Annual Report on Alkali & C. Works 1973. Dept. of the Environment, Scottish Development Dept. Welsh Office. H.M.S.O. 91p.

The Alkali Inspectorate: The Control of Industrial Air Pollution. A Special Report. Social Audit. Spring 1974.

C.E.G.B. Annual Report and Accounts 1973-74. £1.00.

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Air Pollution Aspects of Emission Sources: Primary Lead Production, a Bibliography with Abstracts. U.S. Environmental Protection Agency.

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Consumers' Guide to the Protection of the Environment. Holliman, J. PAN/Ballantine in association with Friends of the Earth. 50p.

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A Critical Review of Regulations for the Control of Sulphur Oxide Emissions: Particulate Emissions. Air Pollution Control Association (APCA) January 1974.

The Control of Gaseous Sulphur Compound Emission, volume 3, reported proceedings, discussion, session 6. International Conference 10-12 April 1973. The North Western Branch of the Institution of Chemical Engineers in association with the University of Salford.

Development Control: Package Buildings. Council for the Protection of Rural England. 1974, 15p.

Dungeness B. Nuclear Power Station. C.E.G.B. 1973.

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Electricity Supply and the Environment. Arthur Hawkins. (November 1973). C.E.G.B.

The Environment of Nuclear Stations in England and Wales. Peter Williamson. (January 1973). C.E.G.B.

Situation en 1970 et prévisions pour la période 1971-1975 (VI. plan). **Évaluation du coût de la prévention de la pollution atmosphérique dans l'industrie en France.** Published on behalf of 'Environment' by La Documentation Francaise. Paris, 1974.

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Flue Gas Desulfurization: Answers to Basic Questions. U.S. Environmental Protection Agency.

Department of the Environment. Report of the Second Working Party on Grit and Dust Emissions.

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Extract from Report on the Health of the City of Manchester 1972. Health Department, City of Manchester.

Hinckley Point B. Nuclear Power Station. April 1971. C.E.G.B.

Lead in the Environment and its significance to Man. A Report of an Interdepartmental Working Group on Heavy Metals Pollution Paper No. 2. H.M.S.O. 1974. 45p.

Liaison between Industry and the Local Authority, Coventry. Pollution Prevention Panel.

The Measurement of Particulate Immissions and Emissions. Coles, E. R., and Shak, B. J. J. British Steel Corporation.

The Monitoring of the Environment in the United Kingdom. Department of the Environment. 1974. H.M.S.O. 50p.

A National Commercial Waterways Project. Barges and Juggernaut. The Inland Shipping Group of the Inland Waterways Association. 50p.

Nuclear Power in Great Britain. E. S. Booth. March 1971. C.E.G.B.

Odour. Report of the Working Party on the Suppression of Odours from Offensive and Selected other Trades. Part 1, The Assessment of the Problems in Great Britain. Department of the Environment. Warren Spring Laboratories, 1974. £2.50.

Population and the Quality of Life in Britain. Report of the Conference at the Royal Society of Arts. December 1973. 50p.

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The Proposed Dinorwic Hydro-Electric Power Scheme. May 1973. C.E.G.B.

Report on Chimney Emissions—Fiddler's Ferry Power Station. Dr. A. E. Martin. C.E.G.B.

Report on Chimney Emissions, Ratcliffe-on-Soar Power Station. Dr. A. E. Martin. C.E.G.B.

Some Recent Trends in Pollution and Health in London—and some current thoughts. Prof. P. J. Lawther.

A Study of Waste Disposal, Waste Recovery and Pollution Control Systems as they affect Local Authorities. Part 11A. Air Pollution Monitoring and Enforcement Systems. A Report for the IBM (U.K.) Scientific Centre. 1974.

Tall Stacks—How Effective are they? by A. J. Clarke, D. H. Lucas and F. F. Ross. July 1971. C.E.G.B.

Towards a Clean Air Policy. A. J. Clarke, G. Spurr and S. Catchpole. March 1971. C.E.G.B.

Transport-Co-ordination or Chaos? Council for the Protection of Rural England. 1974. 15p.

Transport, the Environment and the European Economic Community. Co En Co.

VDI Berichte. Ausbreitung Luftverunreinigender Stoce. (Some English Translations.) Verein Deutscher Ingenieure.

War on Waste:

A Policy for Reclamation. September 1974. Govt. Green Paper. H.M.S.O. 31p.

Films and Filmstrips

Following is a list of films and filmstrips on varied pollution and environmental aspects. Application for the loan of films should be made to the issuing organisation referred to in the lists.

A key to addresses of these is given at the end of the list. The films are available on free loan unless otherwise stated. Two or three weeks advanced notice of hire should be given. The running time of films in minutes is given.

The Society welcomes information on other films suitable for inclusion in future editions of the Year Book.

And on the Eighth Day . . .
Outstanding programme on the pollution of our environment, in four sections:

1. WATER: we all know about rivers, but the sea itself is being affected. Even with more advanced techniques of sewage disposal many problems remain, and industrial waste increases.
2. AIR: Even if the poisonous fumes could be eliminated there are the long-term effects of the building up of carbon dioxide which could have far-reaching effects on the life of the planet.
3. EARTH: Pesticides and chemicals applied to the soil are already causing concern in killing off wild life, but some fear that already the effects are disastrous and irreversible. The delicate balance on which life and our lives depend is being destroyed. Some American scientists, realising this, are being persecuted or at best ignored by big business interests who will not face these facts.
4. FIRE: Deals with pollution by radioactivity, not only used for weapons, but also for industry. Waste is stored in vast quantities and can leak out if there is an earthquake or explosion. A serious and challenging film on a subject of the most vital importance. A Thames TV production, 1970.

Colour 60 mins. NSW £7·00

The Battle for Urban Mobility
Somebody very funny once said that if you put three million cars bumper to bumper you'd be in Los Angeles. Very funny. This film is about America's love affair with the car. It's also a film about America's disenchantment with the idea of public transport. And yet that is the choice; automobiles that will kill the cities, slowly, yet surely, or systems of public transport that will save them. Vested interests with a stake in the car industry try to delay this. Somebody very serious once said that if you put three million cars bumper to bumper, you'd be better off taking the bus or train. Westinghouse Broadcasting Co., U.S.A.
Colour 50 mins. £7.00

Boomsville
Cartoon tracing the growth of a typical city, from a tiny settlement in the North American wilderness to the car-clogged metropolis that so many cities are today. National Film Board of Canada 1968.
Colour 10 mins. £2.00

Bronchitis
Bronchitis is called the English disease, partly because of our climate. Three factors cause it: polluted air, working conditions (such as mining) and smoking. The last is up to the individual: the connection is definitely proved. But are we doing enough about clean air? Many of our cities have no smoke restrictions, and even when such restrictions exist, nothing can be done about poisonous fumes which cannot be seen. Bronchitis is a very distressing illness, which causes a very high number of deaths each year compared with other diseases. Could more be done to prevent it? Granada "World in Action" Programme. 1965.
B/W 25 mins. £3.00

THE CITY

A series of films under the title "Lewis Mumford on the City". 1963. B/W each part 28 mins. Each £3.00.
Six films by the National Film Board of Canada based on Lewis Mumford's book "The City in History". Filmed in eleven countries, the six films of the series are an engrossing study of the city as it once was, the city as we know it now, and the city as it once was, the city as we know it now, and the city as it may be if it survives the dangers which Mumford makes clear. (Each part is complete in itself).

Part I. **The City—Heaven and Hell**
The opposed natures—creative and destructive—of the city in history, the elements that created the first cities, and the forces that now threaten to destroy "man's most precious collective invention".

Part II. **The City—Cars or People?**
An old but dangerously growing problem—how to make the city accessible for meeting and mixing without allowing transportation to make it congested and uninhabitable, as the motor car threatens to do.

Part III. **The City and its Region**
History shows that cities thrive best when they live in harmony and balance with the countryside around them. How can this balance be maintained or restored in today's sprawling metropolitan regions?

Part IV. **The Heart of the City**
A study of the growing sterility, dullness and congestion that is destroying the vitality, variety and breadth that once made cities physically attractive and humanly creative.

Part V. **The City as Man's Home**
Slums, giant public housing complexes, mass suburbs, anonymous and bleak luxury apartments — almost everywhere in our cities communal standards of living are falling as personal standards rise. How did this happen and what can our cities do to improve communal living standards?

Part VI. **The City and the Future**
In more and more regions of the world the inevitable and urgent choice must be made—low-grade urban sprawl or a new kind of regional city. Prospects and ways to restore its role as the focus of man's highest achievement.

City Limits
What are the factors that make a city a pleasant place to live and work in, with its own character and life? Jane Jacobs examines the trends that are killing cities now, particularly the private car, mainly in North America, but we have lessons to learn here before it is too late. 1972.
Colour 30 mins. £4.40

Conservation and Balance in Nature
A comprehensive picture of man's relationship to his environment, and the inter-relationship of the living things themselves. Examples of various environments and different kinds of living things are shown, and also the use of pesticides and chemicals, and the film ends by stressing man's responsibility to use wisely his natural environment.
Colour 18 mins. £3.00

Dead Earth
An ecology film which links together the issues of the survival of our environment with those of corporate responsibility and the use of ecology destroying defoliants in South East Asia and elsewhere. Commentary by the noted ecologist Barry Commoner. Starts with a witty and explicit cartoon. 1971.
Colour 20 mins. £3.00

Don't Spoil Our World (Filmstrip)
A colour filmstrip of paintings by schoolchildren in Ipswich about pollution—how it affects their lives, and all life. Includes a poem. 1973.
Colour 35 films with text
Sale only: £3.00

The Drag
Amusing and fast-moving cartoon about smoking, suitable for all audiences, including schools (and also film societies). A subtle knock at the cigarette advertisers, and those who believe the advertisements. National Film Board of Canada. 1967.
Colour 9 mins. E £2.00

Element Three
The water supplies of the world cannot for long continue to slake the thirst of the land and of men unless in the near future hydrological work of considerable scope and variety is carried out. By means of a poetic quality that is sometimes tragic, as well as through the information it provides, this film demonstrates the complexity and urgency of the problem. Produced by the National Film Board of Canada in co-operation with U.N.E.S.C.O. "A wonderful and beautiful film. Engenders responsibility in community—encourages careful use socially and industrially".—U.N.A. Branch. 1965.
Colour 45 mins. E. £4.00

The Facts Are These
A series for 15 year olds and over, approved by the Educational Advisory Council for I.T.A., and made by the Schools Department of Granada Television, 1973.
Colour 20 mins each. Each £3.00

In a Cleaner, Greener Land
Starts with the industrial revolution, relating it to later pollution of air, water and land. The effects of smoke, effluent in rivers, and litter on the ground are shown, and some efforts by groups of people to combat them, such as direct action by young people in taking back non-returnable soft drink bottles to the manufacturers.

First Mile Up
Air pollution. An examination of the problem, with explanations of its causes and dangers, and comments by experts, including Dr. Linus Pauling. National Film Board of Canada. 1961.
B/W 30 mins. E £3.00

For Your Pleasure
A really delightful cartoon by Derek Phillips, on the growth of motorways and tall buildings. The advance of the concrete jungle on the beauty of the Suffolk countryside in Constable's famous landscapes. A humorous cartoon with serious undertones. 1970.
Colour 5 mins. W £1.60

A Funny Thing Happened on the Way to the Garbage Dump
The problems of sewage and waste disposal, and some positive ideas for overcoming them, for instance in Paris where the refuse is burnt in furnaces which provide parts of the city with hot water. The importance of salvaging metals, and other ways of using waste are shown. The technology exists to conquer waste and pollution, but at what price? BBC TV. 1970.
B/W 51 mins. £4.40

I Tried Cotton Wool, but it Made My Ears Go Funny
Do most of us really know the price that is being paid by people who live near the new great motorways and their junctions, for this "progress"? This film examines the impact of "Spaghetti Junction" (Gravelly Hill intersection at Birmingham), on the inhabitants of that area. Made by John Morris, 1973.
Colour 30 mins. £4.40

Keepers of the Wilderness
So many wild animals are in danger of extinction that scientists have to learn more about their habits to try to preserve them. Bears are branded, and have transmtiters fixed to them so their movements can be traced, and birds are caught and ringed. Is there soon to be no place for animals in the world, if they don't directly serve man? National Film Board of Canada, 1972.
Colour 30 mins. £4.40

King Size
It is aimed at youngsters—but every adult, smoker or not, will benefit from this advice to stay away from tobacco. This is an animation film, and so anything can happen, and does, including a visit to the kingdom of King Size where no smoking is forbidden. Assaulted on all sides by cigarettes or cigarette smoke, our young hero soon has had enough. Home once more, he is ready to do his bit against the menace. What he does is as amusing as the rest. National Film Board of Canada. 1968.
Colour 7 mins. £1.60

Let's Discuss Smoking
A straightforward discussion on the likely effects of smoking, in which a group of teenagers question Dr. F. R. Wake, of Carleton University (Canada). Many aspects are mentioned, among them the problem of parents who smoke! National Film Board of Canada. 1964.
B/W 16 mins. £2.00

Limits of Growth
The problem of our world points to disaster in the future. A group of influential academic and businessmen get together, with the help of a computer, to analyse the problems and find some solutions. It appears that all the issues (violence, pollution, starvation, population growth) are interlinked, and it would be of no use to attack just one aspect. A powerful and stimulating film by Richard Broad, who made "And on the Eighth Day", which shows the urgency with which we need to do something, and could help everyone to see more clearly the direction in which we should work to avert world chaos. Thames TV. 1972.
Colour 60 mins. £7.00

Little Man, Big City
A cartoon which dramatises the plight of today's city dweller. The "little man', lives in a typical urban centre where poor planning, haphazard design and inadequate health controls have depleted him emotionally and physically. Beseiged by overcrowding, noise, pollution, lack of privacy and open spaces, and the hectic and uniform pace of living, even in the confines of his small apartment, he cannot escape the noxious effects of his surroundings. Made by Hungarian Film Studios for the World Health Organisation.
Colour 10 mins. £2.00

London, Unique City
Where other cities have grown upwards, London has ever increasingly edged her boundaries outwards into the Home Counties. This has been partly due to the denizen's desire to combine housing with areas of greenery. What methods can be used to solve the problem of London's sprawl?
B/W 30 mins. £3.00

A Long Time Dying
In County Durham 121 villages are to be "run down" and eventually demolished. Building and development in these places is stopped and they are gradually demolished. Made at Witton Park, one of these villages, which still obstinately refuses to accept that it must die. Interviews with people who live there, and would like to continue to, and with politicians. Thames "This Week" programme. 1969.
Colour 27 mins. NS £4.40

A Matter of Attitudes
Pollution in Canada. A project to discover how much people are aware of pollution, and what they feel should be done about it. What is pollution? How does it affect this country? Who should be responsible for doing something about it? Useful for starting an enquiry into pollution. National Film Board of Canada. 1968.
B/W and Colour 30 mins. £3.00

Multiply and Subdue the Earth
Deals in considerable detail with man's misuse of his environment. Examples are shown of how man has failed to work in harmony with his surroundings, and the resulting pollution and environmental disaster. Useful not only for ecology but also General Studies and "A" level work on the geography of the United States. An excellent film in all respects. Pro duced by National Educational Television, USA. 1970.
Colour 50 mins. £7.00

The Pavement (Bruk)
Polish cartoon about a man who is covering the whole world with paving stones. He finally comes to the last tree, and realises too late what he has done. Shown at Overhausen. 1972.
Colour 10 mins. £2.00

Persistent and Finagling
The true story of a pressure group (Stop: Society to Overcome Pollution) in Montreal. They are mostly women, who plan a project, and feel they need the support of a big-name personality only to wonder if this was a good idea when he agrees. (Persistent and finagling are his epithets for them.) As much an examination of the members of the group as their actions. National Film Board of Canada. 1971.
B/W 60 mins. £4.00

Poisons, Pests and People
The effects of widespread use of chemical insecticides, shown and discussed by experts. We have come to depend on these—perhaps too much, as Rachel Carson's 'Silent Spring' pointed out—but life might be impossible now without them. Some experiments with new techniques are shown. National Film Board of Canada film. 1960.
B/W 60 mins. £4.40

Pollution Series

The First Pollution
This information survey of water quality management and improvement techniques examines the use of both classical and new methods of waste water treatment in various industries and towns in America. Both ways are designed to remove oil, acid and organic chemicals and so produce water that can be recycled and used for a variety of purposes. Other new techniques explained include the use of computers, using sludge as a resource and using microbes in the reclamation process. This film effectively demonstrates that water quality standards can be set and enforced and urges the public to act. 1966.
Colour 26 mins. £3.90

The Second Pollution
The pollution that affects us most personally is the pollution of the aid we must breathe. Los Angeles provides a case history of a city that has worked for decades to reduce the air pollution from both stationary and mobile sources, and yet still has a serious problem today. Chicago is using new laws and strict enforcement to control sulphur oxide emissions produced in the burning of fossil fuels. Automobiles spit out hydrocarbons, carbon monoxide and nitrogen oxides, and current efforts are primarily focused on catalytic conversion to more acceptable materials and redesign of the internal combustion engine. 1966.
Colour 22 mins. £3.80

The Third Pollution
Improved methods for handling 150 million tons of solid waste disposed of each year in the U.S.A. are explained, and examples given of a sanitary landfill in Los Angeles and an incineration plant in New York that not only burns 750 tons of water per day without causing air pollution, but has a waste heat recovery unit that generates power and converts salt water to fresh water. The problem of the disposal of livestock waste are also raised, and of the recycling and salvage of scrap metal, particularly cars, and new ways in which waste solids can be converted into gas and charcoal explained. U.S.A. 1966.
Colour 23 mins. £3.80

Population and Pollution
Short film linking these two vital subjects, and pointing out some ways in which the natural environment can be appreciated. Suitable for older school children upwards. U.S.A. 1970.
Colour 18 mins. £3.00

Recycling
While America slowly buries itself beneath piles of disposable cans and gutted automobiles, efforts are being made throughout the country to salvage and re-use some of the solid waste that grows more profuse every year. "Recycling" is a filmed survey of some of these noble attempts to dig the nation out from under its own refuse. Skillfully proves that almost every form of solid wastes, from newspapers to spoiled peaches, could be rescued from mounting scrap heaps and turned into a high quality product. U.S.A. 1971.
Colour 21 mins. £3.20

River With a Problem
Water pollution. The Ottawa River is an example of what happens when a river is used as a dumping ground for city and industrial waste. Animation illustrates exactly what happens to water as it becomes polluted. Engineers, health authorities and civic officials voice concern over this increasingly urgent problem. National Film Board of Canada. 1961.
B/W 28 mins. E £3.00

The Romance of Transportation
Amusing colour cartoon about transport in Canada, from the Indian canoes to the modern traffic jam; told with togue in cheek seriousness. Winner of 10 awards. National Film Board of Canada. 1953.
Colour 10 mins. £2.00

Smoking and Health—
A Report to Youth
Is smoking worth the risk? How the trachea, bronchi and lungs work, and how they are affected by smoking, are shown by animation sequences, and the evidence about bronchitis, emphysema and lung cancer and their proved connection with smoking is set out, especially as these affect young people.
Colour 13 mins. £2.20

Smoking—It's Your Choice
A factual film showing the actual harm smoking can do—emphysema, cancer of the lungs or larynx, heart trouble, etc, yet young people continue to smoke—why? Some of the answers are gvien: the others all do; to look grown up. An open-ended film to start discussion. U.S.A. 1971.
Colour 15 mins. £2.60

Solutions
British Transport Films
Road versus rail; a short film in popular style without a commentary which suggests that motoring has its snags, and it's quicker by rail (even if you take your car on the train with you.) 1972.
Colour 8 mins. £1.00

The Stripping of Appalachia
Strip coal mining is being carried on in the Appalachian area of America on a large scale, with no consideration for human or animal inhabitants. A British company is largely responsible. Granada "World in Action" programme. 1972.
Colour 30 mins. £4.40

Suburban Living—Six Solutions
A comparison of solutions to the problems of suburban living as found in some of the world's largest cities—London, Marseilles, Rotterdam, Stockholm and Toronto. In this film you see housing to delight, amaze, and even provoke. You see Marseilles' famous community on stilts, with stores, homes, playgrounds all within one vertical neighbourhood. Town planners and architects discuss trends and problems. National Film Board of Canada. 1960.
B/W 58 mins. £5.00

Teesside? We Only Live Here
Man is poisoning earth—the soil, the water, the atmosphere. Teesside, one of Europe's largest industrial complexes, where the rain is turned into sulphuric acid, the air is considered lethal, and the river carries the untreated sewage of half a million people. Why is nothing done about it before it is too late? Apathy? Because there is no profit in pollution control? Is progress the cost of earth we live on? Thames "This Week" programme. 1969.
Colour 27 mins. N £4.40

That's the Price
Pollution and prosperity often go hand in hand, and this film is a sensitive record of what happened when a multi-million company came to a derelict mining area in British Columbia to operate open cast mining on a scale never before attempted anywhere. The effect on the topography of this very beautiful area, and more particularly on the people who lived near and had to move are tellingly shown. One old man, who had been squatting illegally, surveys the ruins of his home after it had been bulldozed by the company. Objectively, one knows he should not have been there, but seeing his anger, frustration and utter bewilderment, one knows this sort of thing ought not to be done to a person. Prosperity was brought back to the neighbourhood, but was the price of it too high? National Film Board of Canada. 1971.
Colour 40 mins. £6.40

A Time for Decision
Smoking—an animated film giving facts about smoking and health, examining the reasons why some people don't believe the evidence, and others know it all and still smoke. An American film, but relevant here, too. The subtle persuasion of advertising, and its changed emphasis since the facts became known is shown. 1967.
Colour 16 mnis. £2.60

Tilt
Witty cartoon in a popular contemporary idiom about the serious issues which face the world; over-population, starvation, and people's selfishness when confronted with these. Is there any possible solution? should start a lively discussion with young people. National Film Board of Canada. 1972.
Colour 14 mins. £2.60

What on Earth?
Shows what many earthlings have long feared—and what Martians might logically deem to be the case—that it is the car which has inherited the earth. An animated film, which shows life on earth as one long unending conga-line of cars which, of course, the Martian visitors judge to be the true inhabitants of earth, while we seem to be parasites infesting them. National Film Board of Canada. 1966.
Colour 10 mins. £2.00

Where There's Smoke
A number of amusing cartoon spots making the point that smoking is harmful and stupid. Suitable for children especially. National Film Board of Canada. 1972.
Colour 14 mins. £2.60

Who Stole the Quiet Day?
Noise—what effect does it have on us? We are increasingly exposed to high noise levels, which we cannot shut out as we can light with our eyes. Shows how the ears work, and how hearing loss occurs, and the other health problems caused by loud noise. Is there anything we can do to improve the situation? Suitable for most age groups. U.S.A. 1973.
Colour 16 mins. £2.60

The above Films are all available from Concord Films Council

The Tide of Traffic
The motor vehicle has become indispensable and our modern world unthinkable without it—but as its use increases, so, too, do the problems it creates. Man now finds himself caught in a dilemma between the motor vehicle's massive benefits and the social and environmental problems brought about by the scale of its usage.
Colour 35mm or 16mm. 28½mins.
The Petroleum Films Bureau.
On free loan.

Something Can be Done about the Water
Everywhere the population is increasing, especially in the industrial areas and along the big rivers, and the disposal of waste is a major problem. Life is impossible without water and our rivers are suffocating and dying. Although there is no complete cure for this complicated problem, one remedy is flocculation agents, which accelerate the deposition of solids and facilitates the dehydration of sludge. This film shows the use of Sedipur for the treatment of industrial waste water and municipal sewage.
17 mins. BASF No. 185 2603-3
On free loan
Guild Sound & Vision Ltd.
Kingston Rd, London SW19 3NR.

Air Pollution—Three Films from Loughborough University of Technology

1. Sources & Effects
The sources of the five contaminants responsible either singly or in combination for most air pollution are detailed, and their effects on people and the environment examined (Sulphur dioxides, carbon monoxide, nitrogen oxides, hydrocarbons and lead). Overall the film puts pollution in historical perspective and shows what information is required and what action needs to be taken continually to improve the situation.
Colour 16mm sound
Approx. 25 mins. £12 per day

2. The Science of the Situation

Very scientific and technical in detail.
Colour 16mm sound
Approx. 25 mins. £12 per day

3. Methods of Control

This film examines how intelligent legislation concerning air pollution must avoid serious economic damage to industry or the community, yet recognise the need for control. Methods of control examined are process modifications, pollutant removal and pollutant dispersion. Meteorological factors are illustrated and the special interest of vehicle pollution is acknowledged and methods of tackling the problem are discussed.
Colour 16mm sound
Approx. 25 mins. £12 per day

Change for Safety

Shows the nuclear safety rules being applied in a nuclear power station. Power station workers are depicted going about their normal business, adherence to the rules making them completely safe from the effects of any radiation. Different types of radiation are explained in diagrammatic form.
Colour 16mm/35mm 24 mins.
On free loan
Film Library C.E.G.B., Sudbury House, 15 Newgate St., London EC1A 7AU.

How Steam is Produced

Describes the production of steam in power stations using coal, oil and nuclear fuel. Animation is used extensively to show the complete sequence of operations, from the arrival of the fuel to the output of electricity.
Colour 16mm/35mm 18 mins.
On free loan
Film Library C.E.G.B., Sudbury House, 15 Newgate St., London EC1A 7AU.

How Electricity is Made (To follow How Steam is Produced)

Colour 16mm/35mm 21 mins.
On free loan
Film Library C.E.G.B., Sudbury House, 15 Newgate St., London EC1A 7AU.

It's All Man Made

Environment is largely a matter of choice. We choose to pollute, to preserve, to raze or repair, to do something or to sit back. The river Trent, in its 128 mile journey to the sea, passes through almost every environmental problem which faces us.

'It's All Man Made', a film from the Department of Environment, presents its audience with evidence of past and present choosing as it follows the course of the Trent. It testifies to problems certainly, but also to effort and achievements.

There is now clean air over industrial Stoke, derelict land reclaimed, conflicting demands on a National Park successfully reconciled and Newark is facing up to the special problems of being an historic town. These are some of the elements in a gently persuasive film made for general audiences.
Sound & Colour 35mm or 16mm
28 mins. On free loan
Also stills available.
The Central Film Library, Government Building, Bromyard Avenue, Acton, London W3 7JB.

Kitchen Think

"Kitchen Think" is a new animated cartoon film sponsored by British Gas. With a commentary written and spoken by Frank Muir, it is aimed at those interested in a professional or a personal way in domestic kitchen planning. It provides a light-hearted look at the ways in which man has developed the place where cooking is done.

The film traces the progress of kitchens from a fire in a prehistoric cave to the streamlined split-level kitchen of today. With its humorous approach goes a great deal of solid advice on how to plan a kitchen.

A kitchen is more than a room. It is the engine room, the nerve centre, the point at which most of the functions of the household are focused. Nor, contraray to popular belief, is it always the trap into which the female of the human species is enticed. More than mere cooking takes place in the kitchen!
Colour 16mm
10 mins. On free loan
British Gas Film Library, 16 Paxton Place, London SE27

Clean Air City

A film on Sheffield's victory over smoke.

The 25-minute documentary explains the City's vigorous application of the Clean Air Act, making Sheffield the first major industrial city in Britain to be covered throughout by smoke control regulations.

Entitled "Clean Air City", the film includes shots of the dirty pre-war Sheffield, and illustrates how, since 1959, the City has progressed steadily to a situation in which every building—every house, every factory—is banned by law from emitting smoke. In addition to explaining the Corporation's 13-year clean air programme, the film includes interviews with civic and industrial leaders, and members of the general public, to illustrate the thinking behind and the results of air pollution control—better health, improved plant life, less industrial absenteeism, and a higher quality of life.
Colour 25 mins. On free loan
Sheffield Publicity Office, Yorkshire Bank Chambers, Surrey Street, Sheffield S1 1LP.

Dust Sampling in Ducts and Chimneys

This film is based on two articles published in the magazine *Environmental Health* for January 1971 by Dr D. F. Ball and Mr D. L. Griffiths of Salford University.

The film describes the theory and illustrates the practice of dust sampling, showing both the conventional method and the B.C.U.R.A. cyclone method. It is intended for people who have no previous experience of these techniques.
Black and white
16mm optical sound track
52 mins. £10·00
Audiovisual Media Unit, University of Salford, Salford, Lancs M5 4WT

The Air My Enemy

The film describes the extensive damage we are inflicting on our environment, and the costly search for remedies.

Contamination of the air is the main theme, but examples of water pollution are also revealed with telling effect. Widespread location filming shows what is happening all over the country. Spokesmen from the North East and Sheffield give contrasting comments on the situation in their own locality, while the success of London's elimination of smoke is dramatically shown.

It is a descriptive film, and does not seek to provide solutions. Natural gas allows the individual to take a decision on his fuel burning appliances knowing that he is making a contribution to a better environment—for it is the domestic chimney which is still an important source of atmospheric pollution. The film aims to help create a climate to intensify pressure for a better, cleaner, environment—for all of us.
Colour 16mm and Sound 25 mins.
On loan
The Gas Council Library, London. 6/7 Great Chapel St., London W1.

Restoration of Land After Opencast Coal Mining

The film provides a practical example of conservation in action. It shows how land is restored to agricultural use after opencast mining.
Colour 16mm and Sound 19 mins.
On loan
National Coal Board Film Unit.

Tomorrow's Coal
Austin Mitchell, television presenter, examines the prospects of the projected Sekby coalfield, and explores the attitudes towards it of some of the people of the Plain of York. Expert opinion is enlisted to resolve the problems which lie ahead, and the Chairman of the Board sums up.
Colour 16mm and Sound 27mins.
NCB Film Unit 1974 On loan

Incinerate—With Coal
Nottingham Corporation incinerate the city's rubbish to fuel the biggest district heating scheme in this country. Coupled with a coal fired heat station, the scheme heats redevelopments in the city centre, several housing areas and existing buildings.
Colour 16 mm and Sound 26 mins.
NCB Film Unit 1973 On loan

27REV3 No. 3 (Twenty-seventh Year)
Warmth From Waste
Heat from the burning of refuse helps coal to warm Nottingham shops, offices and houses.
Colour 16mm and Sound 10 mins.
NCB Film Unit On loan

27REV7 No. 7 (Twenty-seventh Year)
Full Cycle
With the present shortage of fuel the bicycle comes into its own—as a humane machine, efficient and adaptable alike for work and pleasure.
Colour 16 mm and Sound 10 mins.
NCB Film Unit On loan

27REV12 No. 12 (Twenty-seventh Year)
Today and Tomorrow
Britain's coal industry is expanding, to meet the demands of the 80's and after, and to forestall a drastic energy famine. New collieries, as well as reconstructed existing pits can boost output to 150 million tons a year.
Colour 16mm and Sound 10 mins.
NCB Film Unit On loan

The Modern Mine
An impression of the way the mine of the future will be run using remote control techniques, television monitoring devices and a central control panel. This film has been developed from a motion picture presentation devised for the 1965 C.U.M.M. Exhibition.
Colour 16mm and Sound 14 mins.
NCB Film Unit 1966 On loan

Home and Warm
The film deals with the modernisation of an older type house and the installation of modern solid fuel central heating.
Colour 16 mm and Sound 10 mins.
NCB Film Unit 1967 On loan

Welcome Home
Demonstrates the modern equipment available for burning solid smokeless fuels, and the range of these fuels available. The film also describes the Clean Air Act, how it works, and how solid fuel meets its requirements. 'The Solid Smokeless Fuel Federation publication 'Clean Air is for You' is recommended for distribution to audiences of this film.)
Colour 16mm and Sound 22 mins.
NCB Film Unit 1968

Clean Air at Handsworth
This film, a section of 'Welcome Home', describes what happens when a new smoke controlled area is created, and what the householder has to do. It shows three conversions to different types of smokeless solid fuel appliances, quoting the costs, the Local Authority grants, and also, in one case, the National Coal Board's Housewarming plan.
Colour 8 mins. On loan
NCB Film Unit 1967/72

Environment in the Balance
The film shows how geological, topographical and social developments in Britain have helped to shape our environment and discusses the problems of industrial expansion, population growth and pollution. Given the technological ability to safeguard the future, the issues depend on us all, as individuals.
Colour 16mm 30 mins. On loan
Shell-Mex Film Library 1970

The River Must Live
River pollution and how it can be overcome by the treatment of urban and industrial wastes. Filmed on the Continent. An unpleasant subject treated sympathetically and practically with splendid photography.
Colour 16mm 21 mins. On loan
Shell-Mex Film Library 1966

Fuel for the Seventies
A film describing the increasing uses of liquefied petroleum gases in idustry and the service provided by Shell-Mex Ltd.
Colour 16mm 14 mins. On loan
Shell-Mex Library 1970

Land Reclamation
Every year nature encroaches on valuable farm land. Every year farmers fight back. This film shows how modern techniques can be used to reclaim flooded land, bracken-covered areas, and land covered with tussocks and woods.
Colour 16mm 25 mins. On loan
Shell-Mex Film Library 1959

Refining
A light-hearted film approach to the problem of explaining to a non-technical audience the basic principles of refining crude oil. A cartoon figure detaches himself from a party touring a refinery. He comments ironically on the formidable technical jargon used by the guide and explains humorously and in easily understood terms what the guide really means.
Colour 16mm 18 mins. On loan
BP Film Library 1968

A Breath of Spring
A film showing how air conditioning can improve internal environments in offices, shops, and restaurants.
Colour 18 mins. Free loan
Electricity Council
Ref. No. 151 3812-8

Living with Electricity
A film about electrical safety in the home.
Colour 35mm Purchase only £1·50p
Electricity Council Ref. No. ECFS1

Make Room with Electricity
A film about home improvement and general improvement areas. Shows how electricity can improve old homes.
Colour 16mm 24 mins. Free loan
Electricity Council
Ref. No. 151 3820-7

No Tipping
Illustrates the "System Dusseldorf" approach to refuse disposal and shows the threat to clean air posed by traditional methods of refuse disposal.
Colour 16mm 14 mins. Free loan
Motherwell Bridge Tacol Ltd.

Incineration—The Burning Question
Shows another method of refuse disposal and pinpoints the national problem of 17 million tons of refuse needing to be disposed of annually.
Colour 30 mins. Free loan
John Thompson Ltd.

The Properties of Coal
Shows how the properties of coal vary according to the areas where it is mined, and how these characteristics affect its behaviour during combustion. The film gives an explanation of swelling number and shows how various types of coal suit different types of stokers.
Colour 16mm 20 mins. Hire £3
H. & B.

Sea Born Treasure
Vividly highlights the background to the discovery of the first major new indigenous source of power since coal; the progress made in bringing it ashore and the isolation and hardships endured by the crews of drilling rigs.

Touches upon the connection this discovery of gas in the North Sea and the effect of its distribution may be expected to have on the national economy and the citizen.
Colour 16mm 25 mins. Free loan
Gas Council

The Choice
The film's main themes are earth, fire and water. It concentrates on what is being done and what can be done, to preserve the environment. Science and technology have already provided most of the answers. Co-operation between industry and the community has already demonstrated that it can yield worthwhile results. Future success will depend on continuing investment, and, above all, a wider, more vigorous co-operation.
Colour 29 mins. Free loan
I.C.I.

It Takes Your Breath Away
A review of the causes of 'dirty air' as produced by domestic and industrial smoke, traffic, etc. The effect on the lungs of living in this type of atmosphere is briefly shown and the film is of value to Public Health Workers as a means of ramming home the ill effects of a smoky atmosphere.
Colour 16mm
10 mins. Hire £1·25 + VAT
British Medical Association

Horsepower and Hydrocarbons
The California Motor Vehicle Control Boad explain the nature and extent of emission problems from the motor car. The alternatives to the petrol driven car are examined, as are methods of reducing levels of emission. The first film to approach all aspects of the problem fully.
Colour 16mm 22 mins. Free loan
NSCA.

FILMS FROM OTHER AGENCIES

TRANSMEDIA LTD., 7 Grape Street, London WC2H 8DR. Prices on application.

"Energy—A Matter of Choices"—16mm col. 22 mins. Secondary.

The following films are produced by Encyclopaedia Britannica and distributed by Transmedia Ltd.—

"Trees and their Importance"—16mm col. 11 mins. Infant and Primary.

"The Everglades"—Conserving a Balanced Community—16mm col. 11 mins.

"House of Man—Our Crowded Environment"—16mm col. 11 mins.

"Problems of Conservation—Air"—16mm col. 15 mins.

"Problems of Conservation—Forest and Range"—16mm col. 14 mins.

"Problems of Conservation—Minerals"—16mm col. 16 mins.

"Problems of Conservation—Our Natural Resources"—16mm col. 11 mins.

"Problems of Conservation—Water"—16mm col. 16 mins.

"Problems of Conservation—Wildlife"—16mm col. 13 mins.

"Noise—Polluting the Environment"—16mm col. 15 mins.

"Buffalo—An Ecological Success Story"—16mm col. 14 mins.

"Controversy over Industrial Pollution—A Case Study"—16mm col. 17 mins. Secondary.

"The Living Environment"—16mm col. 8 mins. Suitable as introduction to ecology.

The following film is produced by Pyramid Films and distributed by Transmedia Ltd.—

"Ecology—Checks and Balances"—16mm col. 14 mins.

RANK AUDIO-VISUAL LTD., P.O. Box 70, Great West Road, Brentford, Middx.

"Noise Pollution"—16mm col. 18 mins. 13+. Hire: £3.

"The Empty Nest"—16mm col. 20 mins. Threat of extinction by pesticides which menaces the Osprey. Hire: £3.

"Deterioration of Water"—16mm col. 19 mins. Displays various pollutants. 13+. Hire: £2.

"Man's impact on the Environment"—35-frame colour filmstrip. Price: £2·10.

EDWARD PATTERSON ASSOCIATES LTD., 68 Copers Cope Road, Beckenham, Kent.

"Waste—The Penalty of Affluence"—16mm col. 18 mins. Inter. Film Bureau Inc. Price: £76.

FIELDS STUDIES COUNCIL, 9 Devereux Court, Strand, London WC2.

"The Hidden World"—16mm col. 19½ mins. Shows work in progress at the 15 field centres and emphasises delicate balance of nature. Secondary upwards. Free loan on application to the Secretary.

KEY TO FILM DISTRIBUTORS

BASF United Kingdom Ltd.
Lady Lane
Hadleigh
Suffolk IP7 6BQ.

BMA—British Medical Association
Film Library
Tavistock Square
London WC1.

BP—British Petroleum
Film Production & Distribution Branch
Britannic House
Moor Lane
London EC2.

British Gas Corporation
16 Paxton Place
London SE27 9SS.

CEGB—Central Electricity Generating Board Film Library
Sudbury House
15 Newgate Street
London EC1A 7AU.

CFC—Concord Films Council
Nacton
Ipswich
Suffolk IP10 0JZ.

Electricity Council Marketing Dept.
Trafalgar Buildings
1 Charing Cross
London SW1.

Gas Council Film Library
6/7 Great Chapel Street
London W1.

ICI Film Library
Thames House North
Millbank
London SW1.

Loughborough University of Technology
Loughborough
Leics LE11 3TU.

Motherwell Bridge Tacol Ltd.
Green Dragon House
64-70 High Street
Croydon
Surrey

NCB—National Coal Board Film Unit
Hobart House
Grosvenor Place
London SW1.

NSCA—National Society for Clean Air
136 North Street
Brighton BN1 1RG
Sussex.

Shell-Mex Film Library
25 The Burroughs
Hendon
London NW4.

John Thompson Ltd.
Ettingshall
Wolverhampton
Staffs.

GENERAL AUDIO-VISUAL TEACHING AIDS (SLIDES, CASSETTES ETC.) ON ENVIRONMENTAL SUBJECTS

Air Pollution. General survey of problems, methods of measurement, etc., prepared in consultation with the Association of Public Health Inspectors. Black and white, plus lecture notes. (Produced by Camera Talks Ltd.)

Environment: Air Pollution, Parts 1 and 2. (1) Local Continental and Natural. 41 frames. (2) Industrial pollution. 38 frames. Colour, plus lecture notes by Professor R. S. Scorer. (Produced by Diana Wyllie Ltd.) Sale price £3 each part.

Chronic Bronchitis. Section 1: Incidence and Causes. Section 2: Treatment and Management. Section 3: Public Health and the Prevention of Chronic Bronchitis. Colour. Lecture notes by Dr. J. L. Burn. (Produced by Diana Wyllie Ltd.) Sale price £2.

Small Heating Systems. Colour. (Produced by Union Head Visual Aids Ltd. for N.I.F.E.S.)

The Problem of Lung Cancer. Colour. (Produced by Camera Talks Ltd.)

Making the Modern Town (Smoke Abatement). A lecture by the Gas Council. Black and white. (Produced by Carlton Hill Film Studios.)

The Public Health Inspector. Colour. (Produced by Camera Talks Ltd.)

The Air You Breathe. Colour, plus lecture notes by Rear-Admiral P. G. Sharp. (Produced by Diana Wyllie Ltd.) Sale price £3 full frame, £2.50 half frame. (Full frame suitable for mounting into slides).

CAMERA TALKS LTD., 31 North Row, London W1.
"Clean Air" "Pollution". Available as filmstrips, £3.95 each: boxed slide sets, £5.95 each Slide sets in albums, £7.50 each. Cassette or spooled tapes to accompany them available at £3 and £4 respectively.

AEROFILMS LTD., Elstree Way, Boreham Wood, Herts.
"Extraction, Conservation and Pollution". Set of 24 aerial photographs taken of different areas in Britain, e.g. air and sea pollution by coastal industrial plant, Workington, Cumberland. Available as 9in × 7in B/W prints, £3.30 set; overhead projector transparencies, £9.35 set; 35mm slides, £3.30 set.

ARCHITECTURAL PRESS, 9-13 Queen Anne's Gate, London SW1.
"Lifescape Series". A series of 10 packs each containing a teacher's guide and 24 different leaflets on the environment, e.g. over-population, motorways. 11+. Price: £1.50. Class sets: £1.20.

EDUCATIONAL AUDIO-VISUAL LTD., Coal Road, Seacroft, Leeds 14.
"The Right to Pollute". Colour filmstrip with teacher's notes and choice of spool tape or cassette—arguments for and against large-scale industrial developments by Third World countries. Price: £9.

DIANA WYLLIE LTD., 3 Park Road, Baker Street, London NW1.
A series of colour filmstrip/slide sets with lecture notes for schools and upwards. Each part of the series is priced at £2.50 single frame; £3 double frame.
"Nature Conservation in the British Isles"—in two parts.
"Population and Resources"—in two parts.
"Air Pollution"—in two parts.
"Water Pollution"—in two parts.
"The Air You Breathe".
"Man-made World"—in four parts.
"Environment: Waste and Recycling".
Additional commentary on cassette at £3.

PITMAN PUBLISHING, 39 Parker Street, London WC2B 5PB.
Series of transparencies for use with 'A' level students and for those in further education.
"Ecology—Part I", set of 33, £15 approx.
"Ecology—Part II", set of 25, £11 approx.
"Pollution", set of 35, £16 approx.

PICTORIAL CHARTS EDUCATION TRUST, 27 Kirchen Road, London W13 0UD.
"Energy". Photo discussion pack on conventional and alternative energy resources, 85p. "Pollution". Ten large photographs with notes, 85p.

THE SLIDE CENTRE, Pontman House, 17 Brodrick Road, London SW17.
A series on the pollution of the environment.
"Pollution—Introduction and Historic Background". Slide folio of 18 slides, £2.
"Pollution—Ponds and Rivers."
"Pollution of the Air".
"Pollution—Us Versus the Rest—Extinction": £1.50.
"Pollution of the Sea".
"Pollution by Waste".
Each of the above slide folios contains 12 slides and costs £1.50 per set.

MACMILLAN EDUCATIONAL, Houndmills, Basingstoke, Hants.
"Conservation". A complete kit providing one term's work for up to 50 pupils 14-16 years. Contents: teacher's book, 24 mark sheets (50 copies of each), four information sheets (30 copies of each), filmstrips on water sources, water pollution, air pollution. Price: £12.50 plus VAT.

EDUCATIONAL PRODUCTIONS LTD., Bradford Road, East Ardsley, Wakefield, Yorks.
"Air Pollution". A study-kit folder containing six work cards, six study prints and data sheet. Produced in collaboration with Gas Council. Price: 50p.
"Caring for our Countryside". A series of filmstrips investigating man's impact on the countryside. The series includes:
"How Natural is our Countryside?"
"Man's Impact on the Countryside Environment".
"Man and the Countryside—Conservation and Reclamation".
Available in single frame £2.10 each; double frame £2.90 each.

THINGS OF SCIENCE (CAMBRIDGE) LTD., Advisory Centre for Education, 32 Trumpington Street, Cambridge.
"Clean Air Research Pack". Introductory booklet, lichen identification chart, zone chart for mapping and BH indicator papers. Price: £1.03.
"Clean Stream Research Pack". Pollution survey sheet, instructions for local survey work, set of cards describing the indicator animals, indicat papers, test tubes. Primary and secondary. Price: 93p.

GATEWAY PRODUCTIONS LTD., St. Lawrence House, 29/31 Broad Street, Bristol.
"Pollution". Six single frame filmstrips and six cassettes. 11+. Price: £38.40.
"Ecological Communities". Six filmstrips and six cassettes. 8+. Price: £36.10.
"Learning About Conservation". Price: £32.80.
"Discovering Our Environment". Four study print sets. Each set includes 10 photographs and teacher's guide, a study guide and a "survival game". 6+. Price: £22.60.
"Treeman—a First Adventure in Ecology". Complete set of 18 study prints, filmstrips and cassette. For six years and upwards. Price: £19.70.

JOHN PARRY, Grenville Lodge, Henley-on-Thames, Oxon.
"Our Spaceship Earth". An unscripted lecture by John Parry, illustrated by colour slides. Age range: primary and secondary. Fee: £10 per visit, plus expenses. (Slides not available for hire separately).

Guide to Publications

This list of available publications on smoke prevention, atmospheric pollution and allied subjects is issued by the Society as a reference guide.

Prices quoted are those current at the date of publication, and are subject to variation. Please add 20% of the total cost of publications for postage and packing, with a minimum addition of 10p and a maximum of 60p. These charges do not apply to orders for the Society's leaflets nor to bulk orders of any one publication or publications.

All orders are sent by second-class mail or parcel post; if specifically requested, publications will be sent by first-class mail, air mail, registered post etc, but the additional costs incurred will be charged.

Information about older, out-of-print, and overseas publications may be obtained from the Society on request. Most of these are in the Society's library and can be consulted, or in some cases borrowed for short periods, by arrangement.

The Society operates a photocopy service, for out of print literature, etc. The price is 7p per page.

N.S.C.A. PUBLICATIONS

General

"Clean Air"
The quarterly journal of the Society. It contains articles, photographs, reports, news items, abstracts and other current information appertaining to air pollution and allied matters. Subscription rate £2.00 per calendar year post free. Single copies 60p.

"Sulphur Dioxide"
An examination of sulphur dioxide as an air pollutant.
2nd edition—revised and updated.
Price: £1.00

"Air Pollution from Road Vehicles"
Problems and control of air pollution from diesel and petrol motor vehicles.
Price: 20p

"The Law Relating to Air Pollution"
A Summary of Legislation.
Price: 15p

"Fumifugium" or "The Smoake of London Dissipated"
John Evelyn's well-known tract (1661).
Price: 25p

"Towards Cleaner Air"
Completely revised and updated.
Price: 50p

"Pollution"
An introduction to the whole subject of pollution for school children and students up to 'O' level standard.
Price: 10p

DES VOEUX MEMORIAL LECTURES

All at 10p each

"The Destructive Effects of Air Pollution on Materials"
Dr. A. Parker, 1955

"Meteorology and Air Pollution"
Sir Graham Sutton 1957

"Clean Air, Urban Amenity and the Growth of Towns"
Sir William Holford 1958

"Clean Air, Public Opinion and the Press"
Sir Linton Andrews 1960

"Clean Air and Future Energy"
Dr. E. F. Schumacher 1967

CONFERENCE PROCEEDINGS

Details of earlier Conference Proceedings available on request.

Harrogate Conference, 1960. The Des Voeux Memorial Lecture — "Clean Air, Public Opinion and the Press," Address by Parliamentary Secretary, Ministry of Housing and Local Government, Series of progress reports on (1) Research and Investigation; (2) Domestic Heating; (3) Industrial Problems, Papers on Air Pollution from Road Vehicles, and an Inquiry into the Working of the Clean Air Act.
Price: £1.25

Brighton Conference, 1961. Opening Address by John C. George, Parliamentary Secretary, Ministry of Power, Presidential Address by Lord Cohen of Birkenhead. Reports on National Survey of Air Pollution. Furnace Operators Bill, Diesel Smoke; Papers on Industrial Aspects of the Clean Air Act, Whole House Heating, Smoke Control Areas and Transatlantic Discussion.
Price: 75p

Harrogate Conference, 1962. Five papers on air pollution in European Countries, a paper on the 1958 Alkali order Processes followed by a paper on Incineration and Waste Disposal.
Price: 25p (Preprints only)

Scarborough Conference, 1963. Address by The Rt. Hon. Lord Hastings, Papers on Smoke Control Areas and their Problems, The Importance of Public Relations, Air Pollution—The Human Problem, Pollution from Road Vehicles, Progress in a Heavy Chemical Industry, The Warwickshire Clean Air Council, Five papers on Research and Development and two papers on grit and dust emissions.
Out of print—photocopy service available.

Harrogate Conference, 1964. Opening Address by the Rt. Hon. Lord Sherfield. Presidential Address by Dr. Albert Parker. Smoke Control Area Reports from eight regions: two papers on Air Pollution and Town Planning, four papers on the future supply of smokeless Fuel; Des Voeux Memorial Lecture—"A Century of Achievement"; a paper on road vehicle pollution and discussion on the Sulphur Dioxide Report.
Price: £1.25

Eastbourne Conference, 1965. Opening Address by John Morris, M.P., Parliamentary Secretary, Ministry of Power, Presidential Address by Sir Alan Wilson, F.R.S. Three Reports on Successes with Smoke Control; two papers on solid fuel distribution and supply problem; air pollution and mortality; odour control; control of pollution from road vehicles; four papers on new horizons in domestic heating; two papers on industrial problems; two papers on unresolved problems in air pollution.
Price: £1.25

Blackpool Conference, 1967. Opening Address by Stephen Swingler, M.P., Ministry of State, Ministry of Transport, Presidential Address by Sir John Charrington. Report on Air Pollution from road vehicles: some specific air pollution problems; Clean Air and the North West Environment; two papers on effects of pollution on environment; Des Voeux Memorial lecture—"Clean Air and Future Energy"; a paper on the emission of grit and dust from furnaces; the cost of smoke control; a report on smokeless heating in new housing, industrial and municipal incineration of refuse; paper on new oxygen-fuel process in steelmaking.
Price: £1.00 (Preprints only)

Harrogate Conference, 1968. Part I: Four papers on Clean Air and Future Fuel Usage, three papers on Chimneys: Progress on Scheduled Works; three papers on the Measurement of Pollution; three papers on Vehicles; Paper on Practical Problems in the Approach to Smoke Control.
Out of print—photocopy service available.
Part II: Opening Address by Sir David Pitblado, K.C.B., C.V.O. Presidential Address by Sir John Charrington and Reports of Discussions.
Price: 75p

Eastbourne Conference, 1969. Part I: Paper on Outstanding Problems in the Heavy Clay and Refractories Industry; The Pottery Industry's Contribution to Clean Air; Air Pollution Control in Oil Refining; Paper on Sulphur Oxides and Fuel Oils, Clean Air and Health in London; Dust Control in the Cement Industry and two papers on Iron and Steel—Progress Towards Clean Air. (A) Review of Progress. (B) Some Practical Problems.
Out of print—photocopy service available.
Part II: Opening Address by Lord Delacourt-Smith, Presidential Address by Sir Kenneth Hutchison on behalf of Baroness Serota and Reports of Discussions.
Price: £1.00

Southport Conference, 1970. Part I: Two papers on the Clean Air Act 1968; Paper on The Disposal of Refuse by Incineration; three papers on Conservation; three papers on Clean Air—the Balance Sheet; four papers on the Fuel Industry's Viewpoint; and two papers on Vehicle Pollution.
Price: £2.00
Part II: Opening Address by Eldon Griffiths M.P. Presidential Address by Sir Kenneth Hutchison, Reports of Discussions, and the paper Conservation in the North-West.
Price: £1.25

Folkestone Conference, 1971. Part I: A report by the Society's Technical Committee on Sulphur Dioxide, two papers on Odours and their Control, three papers on the Meteorological aspects of Air Pollution, three papers on Aircraft Pollution and a paper on the National Survey—Trends in Pollution.
Price: £2.50
Part II: Opening address by Sir Eric Ashby, Presidential Address by Stanley E. Cohen, Reports of the Discussions.
Price: £1.50

Scarborough Conference, 1972.
Part I:
1. Pollution Control—How far can we go?
   Prof. C. J. Stairmand
2. Metals in the Atmosphere
   R. A. Fish
3. The Scheduled Processes
   F. E. Ireland
4. The Chemical Industry and Air Pollution
   F. Whiteley
5. Odour Nuisances in Industry
   T. R. Jones
6. Odour Nuisances in Agriculture
   Dr. F. H. Peakin
7. Effects of Air Pollution on Plants
   Dr. L. H. P. Jones and D. W. Cowling

Part II: Opening Address by Lord Kearton, Presidential Address by Stanley E. Cohen and Reports of Discussions.
Price: 50p per paper or £5.00 complete set together with Part II.

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2. Dartmoor Under Pressure
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3. The Invasion of the South West's Environment
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   F. J. C. Amos
6. Pollution and Health
   Dr. R. Murray
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Cardiff Conference 1974.
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   W. Bate
2. Environmental Pollution: The Technical Aspects of Co-operation Between Industry and the Local Authority
   Dr. R. Jenkins
3. The Propagation and Screening of Traffic Noise
   T. W. Heppell
4. Preliminary Findings of the Five Towns Survey
   Dr. R. G. Derwent and Dr. H. N. Stewart
5. The Prevention of Pollution from the Coal Industry
   D. H. Broadbent
6. The Prevention of Pollution from the Steel Industry
   Dr. A. O'Connor
7. Wild Life and the Effects of Pollution
   Professor K. Mellanby
8. The Measurement of Heavy Metals in the Atmosphere and their Interpretation
   N. J. Pattenden

9. The Use of Moss-Bags as Deposition Gauges for Airborne Metals
   Professor G. T. Goodman, S. Smith, G. D. R. Parry and M. J. Inskip

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Technical Symposium, Manchester, 1972.

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   W. A. Clennel and C. R. Mowle
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   G. Cheater
5. Incineration of Sewage Sludge
   G. Moodie
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   H. G. Mitchell
7. The Role of the Heating and Ventilating Engineer in Pollution Control
   F. M. H. Taylor
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   P. Swift
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    A. J. Moyes and M. Swift
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Part II: Report of the Discussions
Price: 50p per paper or £4.50 complete set together with Part II

Technical Symposium, Oxford 1973.

1. Lead in Petrol—is it Necessary?
   C. L. Goodacre
2. Acceptable Devices for the Control of Emissions
   Expert Panel
3. Why do Diesels Make Smoke—How May it be Abated?
   N. M. F. Vulliamy
4. Regulations Regarding Smoke Emission: Are They Adequate? How Can They be Strengthened?
   P. Draper
5. Control of Pollution in Jet Engines
   M. R. Williams
6. Gas Turbines for Rail Traction
   M. A. Stokes
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   Dr. C. G. Williams

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Technical Symposium, Sheffield 1974.

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   I. C. Cross
4. Environmental Control in the Manufacture of Artificial Graphite
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   Dr. P. B. Simpson
6. Now Solid Fuel Makes a Clean Sweep
   J. G. S. Smith
7. The Contribution of the Alkali Act
   M. F. Tunnicliffe
8. River Pollution Prevention and its Relationship with Atmospheric Pollution
   T. W. Raven
9. Reduction of Combustion Generated Air Pollution
   Professor J. M. Beer and Dr. A. B. Hedley

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INTERNATIONAL CONGRESS LONDON 1966

The following papers are available at 12p each:

Sources and Distribution of Air Pollution Ascertained by Stationary Recording of Gaseous Components. W. Breuer and K. Winkler.

Study of the Effect of Air Pollution Upon Respiratory Diseases in London in the Winters of 1962-63 and 1963-64. S. J. Carne.

Collection of Dust from Refuse Incinerators in Electrostatic Precipitators Provided with Multicyclone After-Collectors. C. Cederholm.

Atmospheric Pollution in Paris by Vehicle Exhaust Gases Measurement of Pollution Levels First Suggested Remedies. P. Chovin and R. Thiebault.

Alleviation of Air Pollution in the Coking Industry. R. L. Cooper and G. W. Lee.

Smoke and Sulphur Dioxide in Great Britain: Distribution and Changes. S. R. Craxford, Marjorie Clifton and Marie-Louise P. M. Weatherley.

Measurements of Concentrations of Particulate Pollutants in Ruhr. K. H. Friedrichs and A. Brockhaus.

The Working Party on Air Pollution—European Federation of Chemical Engineering. D. Gall.

The Concentration of Carbon Monoxide Measured at Different Altitudes Simultaneously in City Streets.
Sulphur Dioxide Concentrations Measured around a Modern Power Station.
E. W. F. Gillham, A. Martin and F. R. Barber.

Oil Burners for Domestic Application; Present Design and Future Developments. B. Gills and E. L. Howe.

Calculated Versus Continuously Measured SO_2 Concentrations with Regard to Minimum Stack Heights and Urban Renewal (urbanisme). K. Gräfe.

Tomorrow's Town Transport—The Advantages of Electric Traction. A. N. Irens.

Method for the Abatement of Air Pollution Caused by Cement Plants. W. Kohler.

Sub-Minute Continuous Nitrogen Dioxide Analysis.
E. L. Kothny and P. K. Mueller.

Determinating Source Reduction Needed to Meet Air Quality Standards. Ralph I. Larsen.

Progress in Air Pollution Controls in South Africa.
C. E. Latsky and E. C. Halliday.

Collection of Dust from Oil-Fired Boilers in Multi-Cyclones and Electrostatic Precipitators. S. Maartman.

Tree Belts as a Protection against the Harmattan in Nigeria.
B. A. Molski.

Towards Cleaner Diesel Engine Exhausts.
R. E. Pegg and A. W. Ramsden.

The Role of Gas in the Reduction of Air Pollution.
F. F. Robb.

Air Pollution Monitoring in Canada.
G. R. Ross and H. J. Wilson.

International Dust and Fume Collection Problems.
G. G. Schneider.

Pioneering Experience with High Stacks on the Ovec and American Electric Power Systems.
P. Sporn and T. T. Frankenburg.

Studies on Automatic Recording Apparatus for Measurements of Oxidants in Air. S. Suzuki.

OTHER PAPERS

1. **Some factors concerning Diesel Engine Exhaust Fumes.**
   J. K. Lock, 1960.
2. **Methods of Removing Smoke from Road Vehicles.**
   L. E. Reed and S. C. Wallin, 1960.
3. **Sampling for 3:4 Benzpyrene in Flue Gas from Plant fired by Petroleum Fuels.**
   E. L. Howe, 1960.
4. **The National Survey of Air Pollution.**
   Marjorie Clifton, S. R. Craxford,
   Mrs. P. M. Weatherley, 1961.
5. **Mitigation of Air Pollution at Coking Plants.**
   R. L. Cooper and J. P. Graham, 1962.
6. **Incineration and Waste Disposal.**
   S. Cayton, 1962.
7. **Power Stations and Clean Air.**
   G. N. Stone and A. J. Clarke, 1963.
8. **Industrial and Municipal Incineration of Refuse.**
   E. J. Ostle, 1967.
9. **Some Minerological Aspects of Air Pollution Damage to Limestone.**
   K. J. Henley, 1967.

Price: 10p per paper.

POSTERS

1. Prevent Air Pollution—Britain's Biggest Headache
2. Lungs, Plants, Animals, Buildings and Your Pocket are being attacked by Air Pollution
3. Couldn't You Do With Some Clean Air?
4. Road Vehicle Pollution

Price: 15p per poster (double crown)
£10 per 100 copies (can be mixed)

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1. Clean Air Begins at Home
2. Prevent Air Pollution

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Price: £5.00 per 1,000

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Ringlemann Smoke Chart (with instructional leaflet). Chart for measuring smoke density. 12p each: 10 for £1.00

'Power's' Microringelmann. Direct facsimile reduction of the standard Ringlemann Chart (McGraw-Hill).
35p each: 10 for £3

H.M.S.O. PUBLICATIONS

Acts and Memoranda

Clean Air Act, 1956. The Statute governing smoke, containing sections on dark smoke, smoke from furnaces, grit and dust from furnaces, smoke control areas, smoke nuisances, special cases, clean air council and miscellaneous provisions. (H.M.S.O., 1956) 4 & 5 Eliz. 2 Ch. 52.

Clean Air Act, 1956. Memorandum on Smoke Control Areas. (H.M.S.O., 1956)

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions. (H.M.S.O., 1956)

Amendment to Model Byelaws. Series IV Buildings (1953) Edition. (H.M.S.O., 1956)

Thermal Insulation (Industrial Buildings) Act, 1957. (5 & 6 Eliz. 2 Ch. 40). (H.M.S.O., 1957)

Clean Air Act, 1956. Memorandum on Industrial Provisions. (H.M.S.O., 1958)

Clean Air Act, 1956. Memorandum on Miscellaneous Provisions (Scotland). (H.M.S.O., 1959)

Housing Act, 1964. (H.M.S.O.)

Clean Air Act (Northern Ireland), 1964. Memorandum on Smoke Control Areas (H.M.S.O., 1965)

West Riding County Council (General Powers) Act, 1964. (H.M.S.O.)

Clean Air Act (Northern Ireland), 1964, Belfast. (H.M.S.O.)
Chimney Heights. Second edition of the 1956 Clean Air Act Memorandum (H.M.S.O., 1967)

Chimney Height Charts. The Appendices to the Clean Air Act publication "Chimney Heights" printed on permatrace. (H.M.S.O., 1967)

Report of the Working Party on Grit and Dust Emission. (M.H.L.G. Memorandum). (H.M.S.O.)

Clean Air Act, 1968. (H.M.S.O., 1968). Eliz. 2 Ch. 62.

The Control of Pollution Act, 1974. (H.M.S.O., 1974)

Health and Safety at Work Act, 1974. (H.M.S.O., 1974)

Statutory Instruments

The Clean Air Act 1956 (Appointed Day) Order 1956
(S.I. 1956, No. 2022)

The Smoke Control Areas (Authorised Fuels) Regulations 1956 (S.I. 1956, No. 2023)

Smoke Control Areas (Exempted Fireplaces) Order, 1957. (S.I. 1957, No. 541)

Clean Air Council Order, 1957.
(S.I. 1957, No. 766)

The Clean Air Act 1956 (Appointed Day) Order 1958 (S.I. 1958, No. 167)

The Alkali etc. Works Order 1958 (S.I. 1958, No. 497)

The Dark Smoke (Permitted Periods) Regulations 1958 (S.I. 1958, No. 498)

The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (S.I. 1958, No. 878)

The Clean Air Act 1956 (Appointed Day No. 2) (Scotland) Order 1958 (S.I. 1958, No. 1931 (C.11) (S.104))

The Alkali etc. Works (Scotland) Order 1958 (S.I. 1958, No. 1932 (S.105))

The Dark Smoke (Permitted Periods) (Scotland) Regulations 1958 (S.I. 1958, No. 1933 (S.106))

The Dark Smoke (Permitted Periods) (Vessels) (Scotland) Regulations 1958 (S.I. 1958, No. 1934 (S.107))

The Smoke Control Areas (Exempted Fireplaces) Order 1959 (S.I. 1959, No. 1207)

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1959 (S.I. 1959, No. 2264 (S.123))

The Alkali etc. Works Order 1961 (S.I. 1961, No. 2261)

The Clean Air Council Order 1957 (Variation) 1962 (S.I. 1962, No. 128)

The Alkali etc. Works Order 1963 (S.I. 1963, No. 493)

The Smoke Control Areas (Authorised Fuels) Regulations 1963 (S.I. 1963, No. 1275)

The Smoke Control Areas (Authorised Fuels) (Scotland) Regulations 1963 (S.I. 1963, No. 1904 (S.103))

Buildings Regulations 1965 (S.I. 1965, No. 1373)

The Clean Air Act (Northern Ireland) 1964 (S.I. 1965, No. 72 (Northern Ireland))

Dark Smoke (Permitted Periods) (Northern Ireland) 1965 (S.I. 1965, No. 73 (Northern Ireland))

Dark Smoke (Permitted Periods) (Northern Ireland) (Vessels) 1965 (S.I. 1965, No. 74 (Northern Ireland))

Smoke Control Areas (Authorised Fuels) (Northern Ireland) 1965 (S.I. 1965, No. 75 (Northern Ireland))

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1965 (S.I. 1965, No. 1284 (S.57))

The Smoke Control Areas (Authorised Fuels) Regulations 1965 (S.I. 1965, No. 1508)

The Smoke Control Areas (Authorised Fuels) Regulations 1965 (S.I. 1965, No. 1951)

The Smoke Control Areas (Exempted Fireplaces) Order 1966 (S.I. 1966, No. 217)

The Smoke Control Areas (Authorised Fuels) (Scotland) Regulations 1966 (S.I. 1966, No. 714 (S.45))

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1966 (S.I. 1966, No. 715 (S.46))

The Alkali etc. Works Order 1966 (S.I. 1966, No. 1143)

The Motor Vehicle (Construction and Use) Regulations 1966 (S.I. 1966, No. 1288)

The Clean Air (Measurement of Grit and Dust) Regulations 1968 (S.I. 1968, No. 431)

The Clean Air Act 1968 (Commencement No. 1) Order 1968 (S.I. 1968, No. 1922 (c.27))

The Clean Air Act 1968 (Commencement No. 1) (Scotland) Order 1968 (S.I. 1968, No. 1941 (c.28) (S.172))

The Smoke Control Areas (Exempted Fireplaces) Order 1969 (S.I. 1969, No. 164)

New Buildings—Prevention of Emission of Smoke (Northern Ireland) (S.I. 1969, No. 6)

The Clean Air (Height of Chimneys) (Exemption) Regulations 1969 (S.I. 1969, No. 411)

The Clean Air (Height of Chimneys) (Prescribed Form) Regulations 1969 (S.I. 1969, No. 412)

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1969 (S.I. 1969, No. 686 (S.58))

The Clean Air Act 1968 (Commencement No. 2) 1969 (S.I. 1969, No. 995 (c.24))

The Clean Air Act 1968 (Commencement No. 2) (Scotland) Order 1969 (S.I. 1969, No. 1006 (c.25) (S.81))

The Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (S.I. 1969, No. 1262)

The Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 (S.I. 1969, No. 1263)

The Clean Air (Arrestment Plant) (Exemption) (Scotland) Regulations 1969 (S.I. 1969, No. 1388 (S.108))

The Smoke Control Areas (Authorised Fuels) Regulations 1969 (S.I. 1969, No. 1798)

The Smoke Control Areas (Exempted Fireplaces) Order 1970 (S.I. 1970, No. 615)

The Smoke Control Areas (Authorised Fuels) Regulations 1970 (S.I. 1970, No. 807)

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1970 (S.I. 1970, No. 1190 (S.97))

The Smoke Control Areas (Authorised Fuels) Regulations 1970 (S.I. 1970, No. 1545)

The Smoke Control Areas (Exempted Fireplaces) (No. 2) Order 1970 (S.I. 1970, No. 1667)

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1970 (S.I. 1970, No. 1762 (S.144))

The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations 1971 (S.I. 1971, No. 161)

The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (S.I. 1971, No. 162)

The Alkali etc. Works Order 1971 (S.I. 1971, No. 960)

The Smoke Control Areas (Authorised Fuels) Regulations 1971 (S.I. 1971, No. 1004)

The Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1971 (S.I. 1971, No. 1199)

The Smoke Control Areas (Exempted Fireplaces) Order 1971 (S.I. 1971, No. 1265)

The Smoke Control Areas (Exempted Fireplaces) (Scotland) Order 1971 (S.I. 1971, No. 1281 (S.164))

The Smoke Control Areas (Authorised Fuels) (No. 3) Regulations 1971 (S.I. 1971, No. 1875)

The Smoke Control Areas (Authorised Fuels) (No. 4) Regulations 1971 (S.I. 1971, No. 2135)

The Smoke Control Areas (Exempted Fireplaces) Order 1972 (S.I. 1972, No. 438)

The Motor Vehicle (Construction and Use) (Amendment) Regulations 1972 (S.I. 1972, No. 805)

The Smoke Control Areas (Exempted Fireplaces) (No. 2) Order 1972 (S.I. 1972, No. 955)

The Gas Safety Regulations 1972
(S.I. 1972, No. 1178)

The Motor Vehicles (Construction and Use) (Amendment) (No. 5) Regulations 1972
(S.I. 1972, No. 1690)

The Motor Vehicles (Construction and Use) Regulations 1973
(S.I. 1973, No. 24)—73p

The Designation of Approval Marks (European Communities) Regulations 1973
(S.I. 1973, No. 1193)

The Motor Vehicle (Designation of Approval Marks) (No. 2) Regulations 1973
(S.I. 1973, No. 1194)

The Motor Vehicle (Type Approval) Regulations 1973
(S.I. 1973, No. 1199)

The Smoke Control Areas (Exempted Fireplaces) Order 1973
(S.I. 1973, No. 2166)

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(S.I. 1974, No. 64)

The Motor Vehicles (Type Approval) (Amendment) Regulations 1974
(S.I. 1974, No. 65)

The Smoke Control Areas (Exempted Fireplaces) (Variations) Order 1974
(S.I. 1974, No. 762)

The Smoke Control Areas (Exempted Fireplaces) (Variations) (No. 2) Order 1974
(S.I. 1974, No. 855)

CIRCULARS

No. 27/57	Clean Air Act 1956 Smoke Control Areas (Exempted Fireplaces) Order 1957
No. 6/58	Clean Air Act 1956 Date of operation of remaining provisions; byelaws under section 24; miners' concessionary coal; approval of new furnaces.
No. 5/59	Clean Air Act 1956 Smoke Control Areas
No. 44/59	Smoke Control Areas (Exempted Fireplaces) Order 1959
No. 28/60	Use of sticks and paper in smoke control areas
No. 1/61	Notification of provisional plans for establishing smoke control areas
No. 12/61	Clean Air — Air Pollution — Measurement and Research
No. 28/61	Selection of open fires for coke burning
No. 31/61	Works of adaptation eligible for Grant
No. 42/61	Industrial furnaces
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No. 4/62	Smoke Control in the Black Areas
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No. 60/62	Smoke Control Programmes 1962-66
No. 7/63	Gas Cokes as open fire fuels
No. 69/63	Smoke Control Areas
No. 46/64	Housing Act 1964 Section 95: Amendment of the Clean Air Act 1956
No. 60/64	Clean Air Act 1956: Housing Act 1964 — Designation of direct acting electric space-heaters
No. 13/65	Smoke Control Areas: Supplies of solid smokeless fuel
No. 51/65	Grant Arrangements
No. 69/65	Tall buildings and Industrial Emissions
No. 77/65	Smoke Control Areas: estimates and final costs
No. 18/66	Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1965
No. 25/66	Clean Air Act 1956 i. Grant arrangements ii. Model Question and Answer Booklet iii. Exempted appliances
No. 42/66	Public expenditure
No. 25/67	Supplies of solid smokeless fuel
No. 52/67	Grit and Dust
No. 11/68	The Clean Air (Measurement of Grit and Dust) Regulations 1968
No. 36/68	Clean Air Act 1956: Housing Act 1964 — Designation of direct acting electric space-heaters
No. 46/68	Clean Air Act 1956: Housing Act 1964 — Designation of direct acting electric space-heaters
No. 69/68	Clean Air Act 1968
No. 2/69	Emissions from Cold Blast Cupolas at Iron Foundries
No. 28/69	(1) The Clean Air (Height of Chimneys) (Prescribed Form) Regulations 1969 (2) The Clean Air (Height of Chimneys) (Exemption) Regulations 1969
No. 29/69	Exempted fireplaces
No. 54/69	Clean Air Act 1968
No. 72/69	Clean Air Act 1968 (a) The Clean Air (Emissions of Dark Smoke) (Exemption) Regulations 1969 (b) The Clean Air (Arrestment Plant) (Exemption) Regulations 1969
No. 97/69	The Smoke Control Areas (Authorised Fuels) Regulations 1969
No. 4/70	Exempted fireplaces
No. 25/70	Exempted fireplaces
No. 42/70	The Smoke Control Areas (Authorised Fuels) Regulations 1970
No. 63/70	Domestic Smoke Control — availability of solid smokeless fuel
No. 85/70	The Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1970
No. 2/71	Clean Air Acts 1956 and 1968 The Clean Air (Emission of grit and dust from furnaces) Regulations 1971; The Clean Air (Measurement of grit and dust from furnaces) Regulations 1971
No. 12/71	The Smoke Control Areas (Authorised Fuels) Regulations 1971
No. 32/71	Maximum Cost Limits
No. 35/71	Alkali etc. Works Regulation Act 1906: The Alkali etc. Works Order 1971
No. 41/71	The Smoke Control Areas (Authorised Fuels) (No. 2) Regulations 1971
No. 48/71	Exempted fireplaces
No. 53/71	Availability of solid smokeless fuel
No. 95/71	The Smoke Control Areas (Authorised Fuels) (No. 3) Regulations 1971
No. 4/72	The Smoke Control Areas (Authorised Fuels) (No. 4) Regulations 1971
No. 24/72	Exempted fireplaces
No. 6/73	Lead and the Environment
No. 10/73	Planning and Noise
No. 53/73	Lead and the Environment
No. 135/73	Clean Air Acts 1956 and 1968 Maximum Cost Limits
No. 3/74	Clean Air Act 1956 Exempted Fireplaces

No. 47/74 Clean Air Act 1956 Fuels for Exempted Fireplaces "Housewarm"
No. 90/74 Clean Air Act 1956 Fuels for Exempted Fireplaces "Housewarm"
No. 131/74 Clean Air Act 1956—Local Government Act 1972—Progress of Smoke Control

MISCELLANEOUS

Committee on Air Pollution.
The Interim Report of the Beaver Committee appointed in July, 1953, to examine the nature, causes and effects of air pollution and the efficiency of present preventive measures to consider what further preventive measures are practicable; and to make recommendations (Cmnd. 9011). (H.M.S.O., 1953)

Committee on Air Pollution.
The Final Report of the Beaver Committee. (Cmnd. 9322). (H.M.S.O., 1954)

110th Annual Report on Alkali &c Works 1973
National Survey of Air Pollution 1961-71
- Vol. 1—General Introduction, United Kingdom—a summary. South East Region (excluding London) and Greater London Area
- Vol. 2—South West, Wales and North West
- Vol. 3—East Anglia, East Midlands and West Midlands

Lead in the Environment and its Significance to Man (A report of an Inter-Departmental Working Group on Heavy Metals)

Odours (A report of the Working Party on the Suppression of Odours from Offensive and Selected Other Trades)—Part I—Assessment of the Problem in Great Britain

SECTION 9

DIRECTORIES

Page

The International Union of Air Pollution Prevention Associations .. 135

Directory of Consultants.. 136

Trade Directory and Buyers' Guide
  Alphabetic Listing 139
  Classified Entries 144

Directory of Organizations 148

The International Union of Air Pollution Prevention Associations

President: Dr. Shindo of the Japanese Union of Air Pollution Prevention Associations

The International Union was originally established in 1965 with six founder members—Argentina, France, Great Britain, Japan, United States of America, and West Germany. The Union consists of non-governmental organisations only and its primary functions are to promote collaboration and the exchange of information on air pollution and environmental problems and to organise, through its member associations, international congresses.

The first congress of the Union was held in London in 1966; the second International Clean Air Congress was held in Washington D.C., U.S.A., from 6th December to 11th December 1970 and the third International Congress was held in Dusseldorf, Federal Republic of Germany, from 8th to 12th October 1973. The 4th Congress will be held in Japan during mid-May 1977.

Since its inception in 1965 the I.U.A.P.P.A. has grown to fourteen full corporate members and four affiliate members.

Corporate Members:

Asociación Argentina Contra la Contaminación del Aire
Sarmiento 680, Buenos Aires, ARGENTINA
Prof. Dr. José A. RISPOLI, President
Prof. Dr. Damian D. TORTI, General Secretary

Clean Air Society of Australia and New Zealand
Box 100, P.O., Lane Cove, 2066, New South Wales, AUSTRALIA
John G. SCHRODER, President
Dr. W. STRAUSS, Council Member

Associacao Brasileira de Prevencao à Poluicao do Ar
Departamento de Saude Ambiental, Faculdade de Saude Publica, Caixa Postal 8099, Sao Paulo, BRAZIL
Eng. Horácio ORTIZ, President
Durval J. CANELLA, Vice-president

VDI-Kommission Reinhaltung der Luft
Graf-Recke-Str. 84, Postfach 1139, 4 Düsseldorf 1, FEDERAL REPUBLIC OF GERMANY
Prof. Dr. Heinrich SCHACKMANN, President
Dipl.Ing. Norbert ENDELL, Secretary

Association pour la Prévention de la Pollution Atmosphérique
62 Rue de Courcelles, 75008 Paris, FRANCE
Y. QUERET, President
Dr. M. SOMMER, General Secretary
I. R. DELANDRE, Director

National Society for Clean Air
136 North Street, Brighton BN1 1RG, ENGLAND
Rear Admiral P. G. SHARP, Secretary General

Associazione Termotecnica Italiana (ATI)
Gruppo Studio Inquinamento Atmosferico (GSIA),
Piazzale R. Morandi, 2-20121 Milano, ITALY
Prof. Carlo PADOVANI, President

Japanese Union of Air Pollution Prevention Associations
c/o Industrial Pollution Control Association of Japan, Shuwa Toranomon No. 3 Building, 18 Shiba-Nishikubosakuragawa-cho Minatoku, Tokyo 105, Japan

Yugoslav Society for Clean Air
71000 Sarajevo, Mašinski fakultet, YUGOSLAVIA
Prof. M. KRSTIC, President
M. FUGAS, Vice-president

SICOM, Stichting Internationaal Contactorgaan Milieubescherming
Postbus 214, Delft, THE NETHERLANDS
Dr. L. A. CLARENBURG, President

Asoc. Mexicana Contra la Contaminacion del Agua y del Aire, A.C.
Torre de Ciencias 5° Piso, Ciudad Universitaria, México 20, D.F., MEXICO
Ing. Humberto BRAVO A.

Schweiz. Vereinigung für Gesundheitstechnik (SVG)
Postfach 305, 8035 Zurich, SWITZERLAND
Walter HESS, President

National Association for Clean Air
P.O. Box 5777, Johannesburg, Transvaal, SOUTH AFRICA
Dr. A. STRASHEIM, President
J. L. EASTERBROOK, Director

Air Pollution Control Association
4400 Fifth Avenue, Pittsburgh, PA. 15213, U.S.A.
Alexander RIHM, President
Dr. Lewis H. ROGERS, Executive Vice-president

Affiliate Members:

The Public Council for the Prevention of Noise and Pollution in Israel
P.O. Box 23047, Tel-Aviv, ISRAEL
David SIVAN, Secretary General

Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.)
Den Norske Ingeniørferening, Kronprinsensgate 17, Oslo 2, NORWAY
Sivilingenior Ivar NESTAAS, Chairman
Alf REISTAD, Secretary

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire
Jr. Moquegua 336- Of. 206, Lima, PERU
Anibal GASTANAGA, President

Asociacion Uruguaya Contra la Contaminacion del Aires
Calle Colonia 1422, P.6, A. 601, Montevideo, URUGUAY
Dr. José Olivera UBIOS, President

Associated Organisation
New Zealand Clean Air Society Inc.
P.O. Box 2365, Christchurch, New Zealand

DIRECTORY OF CONSULTANTS

Acoustic Technology Ltd.
58 The Avenue,
Southampton SO1 2TA
tel: 0703-32995
telex: 47156
579 Barlow Moor Road, Chorlton,
Manchester M21 2AE
tel: 061-881 8807

Noise and vibration consultants. A highly qualified staff of 21 engineers are available to consult on the whole range of noise and vibration control problems including traffic noise surveys, building vibration, and factory noise.

J. E. Arregger & Co.
16a King Street, Twickenham,
Middlesex TW1 3SN
tel: 01-891 1242

A group of professionally qualified engineers offering a design and consulting service to the Petroleum and Process Industries. Specialists in liquefication of natural gas. In addition to chemical and mechanical engineering, design of major electrical and civil projects may be undertaken through this association.

W. S. Atkins & Partners
Woodcote Grove, Ashley Road,
Epsom, Surrey
tel: Epsom 26140

Considerable experience in the prevention of atmospheric pollution from existing manufacturing plants or projected new ones. Experience includes the control of air pollution from steelworks, power stations and incineration plants, as well as pollution surveys for recreational areas.

D. Balfour and Sons
Yeoman House, 63 Croydon Road,
London SE20 7TW
tel: 01-659 2221

Offices in Newcastle upon Tyne, Sheffield, Rome, Singapore, Kuala Lumpur and Brazil.

R. A. Barnes
"Grendon", 64 Brackendale,
Potters Bar, Hertfordshire
tel: Potters Bar 58773

Adviser to The Rugby Portland Cement Company. Specialist on local and regional monitoring and the climatic controls on the long and short distance transportation, dispersion and removal of air pollutants. Works' emissions sampled and estimated.

Bostock, Hill and Rigby Ltd.
35-39 Birchfield Road,
Birmingham B19 1SU
tel: 021-554 2284
telex: 337273

Environmental consulting and laboratory services—industrial effluent, sewage treatment, water quality and treatment, river, sea and air pollution. Services to industry, public utility undertakings, government agencies, local authorities.
Consultancy—treatment process design, commissioning, testing.
Group environmental laboratories: Birmingham, London, Holland, Italy, Singapore.

H. Brown
Energy and Resources Consultant,
10 Westland Drive, Hayes, Bromley,
Kent BR2 7HF
tel: 01-462 7314

Energy problems defined, investigated and remedial action prescribed. Technical and economic teams assembled to suit client requirements. Resource recovery from waste materials investigated in terms of systems' requirements and economic evaluations including market potential in home and overseas markets.

Ronald J. Callow & Associates
18 Towers Avenue
Newcastle upon Tyne NE2 3QE
tel: 0632-81 1134

Consultants on effluent treatment and disposal.

Stanley Cayton, M.B.E., C.Eng., M.Inst.F., F.A.P.H.I., F.R.S.H., M.Inst.S.W.M.
Village Farm,
Great Salkeld, near Penrith,
Cumbria CA11 9LW
tel: Lazonby 528

Consultant: food and environmental hygiene.

A. Cluer, B.Sc., F.R.I.C., F.I.Chem.E., F.Inst.Pet.
"Middlemarch", 3 Oast Road, Oxted,
Surrey RH8 9DX
tel: Oxted 3077

Consultant to Burmah Oil Co., Ex Director Group Refineries Department. Technological advice in all fields of petroleum refining, including associated environmental problems.

*** Brian Colquhoun and Partners**
18 Upper Grosvenor Street, London
W1X 0AP
tel: 01-629 9636

Projects handled in connection with prevention of air pollution apply to power stations, hospitals, chemical industries, hotels, passenger buildings of airports.

British Consultants Bureau
55-58 Pall Mall, London SW1Y 5LH
tel: 01-839 7687

The Counties Public Health Laboratories (Thresh, Beale & Suckling) Ltd.
Thresh House, Verulam Street,
Gray's Inn Road,
London WC1X 8NB
tel: 01-242 1301

Dr. S. R. Craxford, I.S.O.
24 Field Lane, Letchworth, Herts
SG6 3LE
tel: 04626 5085

Cremer and Warner
140 Buckingham Palace Road
London SW1W 9SQ
tel: 01-730 0777
telex: 918666 (Creconsult LDN)

Air quality advice to industry and control authorities in the U.K. and overseas, feasibility studies, technical audits, monitoring surveys, project planning and engineering services.

Dr. J. G. Davis & Partners
Consultant Bacteriologists and Chemists,
52 London Road, Reading, Berks
tel: Reading 81170

Industrial hygiene and microbiology, water sewage, effluents, cleaning, sterilisation, public health, food technology, food analysis, nutrition, and expert witness.

Dr. I. G. C. Dryden, Ph.D., D.Sc., C.Eng., F.R.I.C., F.I.Chem.E., F.Inst.F.
112 Sandy Lane South,
Wallington, Surrey SM6 9RG

Fuel technology (coal).

Eco-Plan
Bridge House, North Road,
Durham City DH1 4PW
tel: Durham (0385) 67226

Environmental Resources Ltd.
35a Thayer Street,
London W1M 5LH
tel: 01-487 3297/3565

Environmental Resources Ltd. are specialists in environmental research: pollution and environmental impact monitoring, analysis and assessment of environmental data, recommendations of pollution control measures and their implementation, cost benefit analyses and economic analyses of least cost methods of pollution reduction, waste disposal strategy and operational plans, technological forecasting and environmental risk assessment.

Multi-disciplinary services are offered to local authorities in the field of waste disposal management, industrial pollution problems and land use development studies.

Fisons Environmental Advisory and Technical Service (FEATS)
Harvest House,
Felixstowe, Suffolk IP11 7LP
tel: 03942 4444
telex: 98273
contact: E. W. Schwehr (manager)

Independent consultancy service covering all aspects of prevention of air, soil and water pollution. The resources of the Fisons Group are available for assessment, research, design, commissioning and technical service.

Charles Forrester, K.i.H., B.Sc., Ph.D., F.R.I.C., M.I.Chem.E., F.Inst.F., F.H.-W.C., F.R.S.E.
1 Hampton Grove, Ewell
Epsom, Surrey
tel: 01-393 1004

Fuel technology, mineral chemistry, utilisation of minerals, forensic science, technical and scientific editing.

Douglas G. Furzey, B.Sc., C.Eng., F.R.I.C., F.I.Chem.E.
Barn Hey, 6 Dinorben Avenue,
Fleet, Hants GU13 9SG
tel: Fleet (02-514) 5653

Economic and technical studies and designs for the process industries including waste and effluent disposal, solvent recovery, furnaces and combustion processes, heating, ventilating, air conditioning, fume control and clean atmospheres.

Gaffney, Cline & Associates Ltd.
GCA International Building,
Rosemount Avenue, West Byfleet,
Surrey
tel: Byfleet 49393

Process Design and Evaluation of all air pollution control installations with special reference to liquid fuels. Considerable engineering experience available for subsurface disposal of wastes.

R. W. Gregory & Partners
Concord House, Feltham, Middlesex
tel: 01-890 1181
also Birmingham, Cardiff, Glasgow,
Liverpool, Manchester,
Newcastle upon Tyne

Mechanical and electrical consulting engineers, specialising in environmental control, heating, lighting and power supplies, commercial and industrial boiler plant and distribution systems. Consultants to Regional Hospital Boards, Universities, Local Authorities and Industry throughout the U.K.

John H. Hastie & Partners
Belmont House, 20 Wood Lane,
Leeds LS6 2AG

Specialists in pollution control who have been consulted on air pollution problems in respect of various industrial complexes and municipal incineration installations in the U.K., Spain, Italy and Belgium.

P. G. W. Hawksley
Process Development Associates
The Sheet, Ludlow, Salop
tel: Ludlow (0584) 3888

H. Hayhurst, M.Sc., C.Eng., F.R.I.C., M.I.Chem.E., M.R.S.H.
"Fouray", Parkfield Road South,
Didsbury, Manchester M20 0DA
tel: 061-445 3224

Infestation of stored products, industrial weedkilling and pest control.

Huntingdon Research Centre
Huntingdon PE18 6ES
tel: Woolley (0480 86) 431
telex: 32100

Industrial hygiene and pollution studies. Experts in health and biological risks associated with ingested and inhaled chemicals and gases. Facilities are also available for determination of pollution on aquatic systems.

International Environmental Bureau for the Non-Ferrous Metals Industry
c/o The British Non-Ferrous Metals Research Association
Grove Laboratories,
Denchworth Road, Wantage,
Berkshire OX12 9BJ
tel: 023 57 2992
telex: 837166

G. V. James, M.B.E., M.Sc., Ph.D., M. Chem.A., F.R.I.C., M.Inst.Env.Sci.
8 Worrall Road, Bristol 8
tel: Bristol 30979

Consulting and analytical chemist. Public analyst. Investigations undertaken into pollution of air, water, land etc.

Kennedy & Donkin
Premier House, Woking, Surrey
GU21 1DG
tel: 04862-5900

Designs of thermal power stations, refuse incineration plants, industrial and commercial undertakings involving environmental engineering of total energy and district heating projects have given Kennedy & Donkin wide experience in pollution control.

Land and Water Management Limited
Principals: A. N. Ede, M.A., M.Sc., Ph.D., G. G. Fisher, B.Sc.
88a Girton Road,
Cambridge CB3 0LN
tel: Cambridge (0223) 76002 and 76898
telex: 817296

A specialist staff can provide expert advice on technical aspects of land use, including restoration of land after disturbance, land reclamation, drainage, engineering design, irrigation, vegetation establishment and control, aquatic weed control, turf culture, planning schemes etc., both at home and abroad.

Marks, Dawes & Associates
1304 Sanlam Centre, P.O. Box 112,
Cape Town, South Africa.

Consulting Chemical Engineers particularly active in the field of waste and effluent treatment, environmental engineering and corrosion.

V. C. Marshall
University of Bradford, Schools of
Chemical Engineering, Bradford,
West Yorkshire BD7 1DP
tel: Bradford 33466

Postgraduate School of Studies in Powder Technology, University of Bradford. Chairman: Dr. J. C. Williams. Concerned, inter alia, with particle fluid interactions and design principles of apparatus for the separation of particles from gases.

Merz and McLellan
Amberley, Killingworth, Newcastle
upon Tyne, NE12 0RS
tel: Newcastle 663955

D. V. Mitchell, C.Eng., M.I.Chem.E.
"Whitewebbs", Woodland Avenue,
Cranleigh, Surrey
tel: Cranleigh 2411

Main activities concerned with handling and processing of solids and dealing with subsequent exhaust emissions, particularly in the scrap metal recovery and animal waste product processing fields including destruction of offensive odours.

Nalfloc Limited
P.O. Box No. 11, Northwich,
Cheshire CW8 4DX
tel: Northwich 75301
telex: 66-8663

Dr. G. Nonhebel
57 Woodley Lane, Romsey SO5 8JR
tel: 0794-513408

Chemical Engineer and Fuel Technologist.

Dr. A. Parker, C.B.E.
5 Wellesley Avenue, Northwood,
Middlesex HA6 3HZ
tel: Northwood 26435

*** Parsons Brown**
Astronaut House, Hounslow Road,
Feltham, Middlesex
tel: 01-890 0842

Civil, structural, mechanical and electrical consulting engineers, undertaking the investigation of pollution, recommendations for its control, design of projects, preparation of specifications and supervision of construction works. Offices in London, Bristol, Birmingham, Portsmouth and Beirut.

Derek B. Purchas, B.Sc., Dip.Chem.Eng., C. Eng., F.I.Chem.E.
"Holmcroft", Heathside Park Road,
Woking, Surrey
tel: Woking 62885

Chemical engineering advice; filtration and separation technology; distillation; effluent treatment; odour control; solvent recovery. Feasibility studies; investigations; design; engineering services; expert evidence; market surveys.

Harvey J. Smith, A.M.C.T., C.Eng., F.I.Mech.E., F.I.E.E., F.I.H.V.E., F.I.Plant E.
Messrs. Harvey J. Smith &
Associates,
60 Box Lane, Bovingdon, Herts

Harvey Smith is a chartered engineer with a wide experience in consulting engineering, local authorities and government research work, and was at one time chief engineer of the Lancashire County Council.

He is equipped with a comprehensive range of equipment for testing pollution of the air by dusts and gases, and for measuring airflow, humidity, air temperature, radiant temperature and the like.

Smith/Sumner Partnership
251 High Street, Orpington,
Kent BR6 0PH
tel: Orpington 36911

Professor C. J. Stairmand, O.B.E.
66 Emerson Avenue, Middlesbrough,
Teesside TS5 7QQ

Consultancy service in environmental studies, pollution control, equipment design and assessment.

J. D. & D. M. Watson
67 Tufton Street, Westminster,
London SW1P 3QT.
tel: 01-222 1564
Terriers House, Amersham Road,
High Wycombe, Buckinghamshire
tel: 0494-26240 & 25464

J. D. & D. M. Watson specialise in the branches of engineering contributing to public health services and the protection of the environment. These include the supply of water to the community; its treatment and disposal after use; flood control; drainage and irrigation; and the treatment and disposal of industrial wastes.

Schemes range from those for great cities to more modest facilities serving communities and industries. Work is carried on in the United Kingdom, Europe, the Middle East, South East Asia and Autsaralia.

* *Entry taken from last issue of "Clean Air Year Book" as no reply received from enquiry.*

TRADE DIRECTORY AND BUYERS' GUIDE

Alphabetical Listing

For Classified Entries see page 144

AAF Ltd.
Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF. Tel: Cramlington (067 071) 3477.

International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Airflow Developments Ltd.
Lancaster Road, High Wycombe, Bucks. Tel: 0494 25252.

Airmaster Engineering Ltd.
Olympia Works, Roundhay Road, Leeds LS8 4BH. Tel: Leeds 656494. Telex: 557227.

Alfa-Laval Co. Ltd.
Factory Equipment Dept., Great West Road, Brentford, Middlesex TW8 9BT. Tel: 01-560 1221. Telex: 22769.

ALFA-LAVAL

Alfa-Laval Company Limited manufacture a range of heat exchangers, including plate heat exchangers which give the highest possible efficiency in central heating and air conditioning applications.

Allaway Acoustics Ltd.
230 Holloway Road, London N7 8DA. Tel: 01-607 3345/6, 01-607 0189. Telex: 28604. Telegrams: Allacoust London N7. Regional Office: 11 Albert Street, Birmingham 4. Tel: 021-236 008.

Wide range of noise and vibration control equipment including silencers, sound proof doors, enclosures, vibration isolators, etc. Consultancy services and site surveys of noise and vibration undertaken. Full acoustical instrumentation held.

Analysis Automation Ltd.
Cherwell Boathouse, Bardwell Road, Oxford OX2 6SR. Tel: (0865) 53713/59020/511851. Telex: 837509 Analysis Oxford.

Analysis Automation specialises in analytical instruments and has the most comprehensive range of detecting and monitoring equipment available in Britain. Analysis Automation Limited both manufactures and imports instruments. Complete systems for air quality, emission monitoring, water quality and effluent monitoring are built in Oxford. Many analysers are available for long or short term hire.

Auriema Ltd.
442 Bath Road, Slough SL1 6BB. Tel: Burnham 61931. Telex: 847155.

The Industrial Instruments Division of Auriema Limited supplies a wide variety of equipment imported from Europe and the USA, including instruments for: contact and non-contact level, density and moisture measurement of liquids, slurries and powders together with flow, temperature and humidity measuring equipment.

Auto Combustions (London) Ltd.
360/364 Wandsworth Road, London SW8 4TF. Tel: 01-622 9121. Telex: Swirlamiser Chamcom/London 888941.

SWIRLAMISER

Trade Names: 'Swirlamiser' and 'Autoflame'. Manufacturers of Swirlamiser oil and gas burners and dual fuel oil/gas high velocity burners and Autoflame oil burners for process heating and all other purposes, furnaces, ovens, heaters, heat exchangers, boilers, water/oil emulsion firing.

Babcock & Wilcox (Operations) Ltd.
165 Great Dover Street, London SE1 4YB. Tel: 01-407 8383.

Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Bacterol Ltd.
115 Lavender Hill, Tonbridge, Kent TN9 2AY. Tel: Tonbridge (073-22) 3188. Telegrams: EVERYSAN, Tonbridge.

The word 'Bacterol' has for many years been well known in health circles, being associated with air disinfection and deodorisation, sterilising and fumigating products and equipment. Enquiries under all these and related headings will be welcomed.

John Bass Ltd.
Bassaire Building, Duncan Road, Swanwick, Southampton SO3 7ZS. Tel: Locksheath 4060 and 4363. Cables: Bassaire, Southampton.

John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd", offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filters modules together with air conditioning, ventilating and ducting services.

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER. Tel: 01-274 4066.
Woodlands Road, Mere, Warminster, Wilts. BA12 6BT. Tel: 074-786 481.
28 Birmingham Street, Oldbury, Warley, Worcs. B69 4DS. Tel: 021-552 2039.

As well as expanding their industrial chimney business Beaumonts are now producing a device known as the Beauvent G.S.C. which prevents most of the unburnt solids produced in oil fired burning from being emitted into the atmosphere. The G.S.C. can be fitted into the base of any new Beauvent chimney.

Bel Sound Products Company
21 Greenfield, Ryde Estate, Hatfield, Herts. Tel: 07072 62915.

F. Brauer Ltd.
Grove Road, Harpenden, Herts. AL5 1PZ. Tel: Harpenden 5288. Telex: 825907 Brautool Harp.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. Tel: 021-236 5391.

Bury & Masco Industries Ltd.
Needlefelt Division, Myrtle Grove, Waterfoot, Rossendale BB4 7JL Lancs. Tel: Rossendale (07-062) 28365.

"Webron"—technical needlefelt designed for fabric dust collectors and liquid/solid separation. Webron filter fabric is available in polyester, polypropylene, acrylonitrile, also high temperature polyamide and P.T.F.E. fibres. Technical advice on all pollution problems concerning filtration media.

Carrier Air Conditioning (UK) Ltd.
Carrier House, Warwick Row, London SW1E 5EL. Tel: 01-834 6858. Telex: 23581 and at York Towers, York Road, Leeds LS9 6TP. Tel: 0532 40061.

Carrier Air Conditioning (UK) Ltd. design and install specialist air conditioning for industrial processes and environmental control, particularly where precise control of temperature, humidity and air cleanliness is essential. Full research and development facilities for specialised application.

Carter Industrial Products Ltd., Midac Dust Control Division
Bedford Road, Birmingham B11 1AY. Tel: 021-772 3781. Telex: 339219.

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N1 7ND. Tel: 01-253 8581. Telex: 261641.

Manufacturers of instruments for sampling industrial air pollution, including dust, gases, chemicals, fumes, SO_2, bacteria and spores; also meteorological instruments and humidity indicators and recorders.

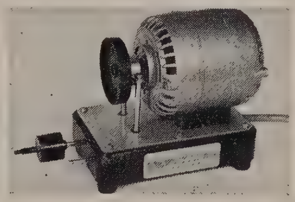
Castle Associates
Redbourn House, Scarborough, YO11 1DE, North Yorkshire. Tel: 0723 66348. Telex: 527244. Cables: Electronic Scarborough.

Castle Associates manufacture a comprehensive range of Sound Level Meters, recorders, monitors, switches etc, many of which are available ex-stock. A few examples are the CS19 range of small inexpensive hand held precision Sound Level Meters and filters. The CC50 automatic 24 hour noise data logging system. The CR173 simple low cost L10 recorder.

R. M. Catterson-Smith Ltd.
Woodrolfe Road, Tollesbury, Essex. Tel: Tollesbury 342.

Electric resistance furnaces (450°C to 1750°C) in standard styles and sizes and also 'specials' to meet individual requirements for pottery glass annealing and decoration, stained glass, enamelling, laboratory processes, wire annealing, heat treatment etc.

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Weybridge, Surrey KT14 7PB. Tel: Byfleet 43224/5. Telegrams: Capumps Byfleet. Telex: 928368.



The Dymax Mk. II 'oil free' diaphragm pump (illustrated) will displace 3 litres of air or gas per minute. It is one of a range of pumps covering flow rates from 0·5 to 70 litres per minute. Further details from Charles Austen Pumps Ltd.

Coalite & Chemical Products Ltd.
P.O. Box No. 21, Chesterfield, Derbyshire S44 6AB. Tel: 0246 822281/9.

REGD
COALITE
TRADE MARK

Coalite & Chemical Products Ltd. manufacture "Coalite" smokeless coal and are Britain's largest independent producer of solid smokeless fuel for open fires, room-heaters and boilers. The Company has three production works in Yorkshire and also one at Bolsover which is linked to "Coalite's" own refinery. "Coalite's" annual production capacity is over two million tons.

Collectron (Dust Control) Ltd.
5 Greenhills Road, Charlton Kings, Cheltenham, Gloucestershire GL53 9ED. Tel: Cheltenham 56355.

Manufacturers of wet and dry dust and fume scrubbing equipment using the newly developed adjustable throat agglomerator system.

Constant Air Systems Ltd.
Raebarn House, Northolt Road, Harrow, Middlesex HA2 0DY. Tel: 01-864 0288.
Devonshire House, High Street, Deritend, Birmingham B12 0LP. Tel: 021 772 5102/3.
Dashwood Avenue, High Wycombe, HP12 3DP, Bucks. Tel: High Wycombe 22744.

Constant Air Systems Ltd. A contracting organisation specialising in the design and detail of all aspects of air conditioning, ventilation and fume removal.

Manufacturing facilities for sheet-metal and steelwork are available from a totally owned subsidiary.

Contracts of considerable complexity are handled by the organisation from the drawing board to commissioning and hand-over.

The Counties Public Health Laboratories (Thresh, Beale & Suckling) Ltd.
Thresh House, Verulam Street, Gray's Inn Road, London WC1X 8NB. Tel: 01-242 1301.

The Electricity Council
30 Millbank, London SW1P 4RD. Tel: 01-834 2333.
Marketing Dept.: Trafalgar Buildings, 1 Charing Cross, London SW1A 2OS. Tel: 01-930 6757.

The Council is the central body for the electricity supply industry in England and Wales, responsible for consultation on and formulation of general policy.

Evans, Adlard & Co. Ltd.
Postlip Mills, Winchcombe, Cheltenham, Glos. GL54 5BB. Tel: 0242 602227. Telex: 43316 (Postlip Filter Paper).

Felvic Group Ltd.
21 Napier Road, Bromley BR2 9JA, Kent. Tel: 01-464 6515. Telex: 896501.

Humidity and Temperature Control; Air Conditioning: Anti-Pollution and Environment Control; Free consultancy and design service on industrial, commercial and domestic applications.

Fleming Instruments Ltd.
Caxton Way, Stevenage, Herts. SG1 2DE. Tel: Stevenage 3101-5. Telex: 82385.

Manufacturers of Air Sampling Equipment, Particulate Pollution Measuring Instruments, Particle Size Analysis Apparatus (1μ-500μ), Radio Active Particle Measuring Equipment and H_2S Gas Monitors (10ppm Alarm level). Ultra-Violet Recording System.

Geldia (London) Ltd.
Holland House, Burmester Road, London SW17. Tel: 01-947 0231.

Cleerburn Incinerators are designed to comply with the requirements of the Clean Air Act and are made to British Standard 3813. Cleerburn models range from 10 cu. ft. to 80 cu. ft. from simple M.S.P. construction to Insulated and Refractory lined models with Primary and After-burners. There is a Cleerburn for every waste problem.

Harleyford Hydrosand Equipment Co. Ltd.
Harleyford, Marlow, Bucks. Tel: Marlow (062 84) 71361. Telex: 847741.

Supply of sewage screenings dewatering conveyor belt presses; animal and other slurry dewatering belt machines; surface and cavitation aerators; low-level bacteria filters; grit dewatering cyclones.

Head Wrightson Process Engineering Ltd.
London Division: 16/22 Baltic Street, London EC1Y 0TD. Tel: 01-253 1299. Cables: Processes, London EC1.

Head Wrightson provide effluent treatment plant, waste heat recovery systems and "tailor made" gas cleaning systems incorporating electrostatic and wet tube precipitators, blockage proof flooded disc scrubbers, cyclones and fabric filters for a variety of industries and uses. The Group Research & Development department is available to assist in design and process problems.

Ideal-Standard Ltd.
P.O. Box 60, Kingston upon Hull HU5 4JE. Tel: 0482 46461. Telex: 52113.

Product: Concord RS/CF (Gas); E Type (Gas); Concord W50 (Gas); Concord H (Gas).

Industrial Acoustics Co. Ltd.
Walton House, Central Trading Estate, Staines, Middlesex TW18 4XB. Tel: Staines 56251. Telex: 25518. Cables: Indcoustic Staines.

Industrial Acoustics Company have 25 years experience in the design, manufacture and installation of all forms of noise control equipment. This includes services to general industry, aviation silencing equipment, air conditioning, noise control and chambers for providing controlled acoustic environment for Medical examination.

The company also operate a noise investigation service and will undertake projects from the investigation to the complete noise control system installation stage.

International Environmental Bureau
c/o BNF Metals Technology Centre, Denchworth Road, Wantage OX12 8BJ. Tel: 023 57 2992. Telex: 837166.

The Bureau studies the air pollution problems in the non-ferrous metals industries and provides to both members and non-members consultancy services and fume monitoring facilities in connection with all aspects of metal melting and processing.

Johnson Matthey Chemicals Ltd.
74 Hatton Garden, London EC1P 1AE. Tel: 01-405 6989.

Abatement of odours or organic content of air/steam by means of Honeycat(R) air pollution control catalytic incineration.

Lee, Howl & Co. Ltd.
Head Office and Works: Alexandra Road, Tipton, West Midlands DY4 8TA. Tel: 021 557 6161. Telex: 338945.
London Office: 375a Regents Park Road, Finchley, London N3 1DE.
Branch Offices:
Crusader House, St. Stephens Street, Bristol BS1 1EL.
4 Heysbank Road, Disley, Cheshire SK12 2BJ.
11 Woodland View, Halam Road, Southwell, Nottingham 3.
6 Greenrigg, Seaton Sluice, Whitley Bay, Tyne & Wear NE26 4HN.
160 Hope Street, Glasgow C2.
Hollywell Road, Cliff Gardens, off Brant Road, Lincoln.

Manufacturers of all types of pumps and pumping equipment.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ. Tel: 021-236 3388.

Lodge-Cottrell Ltd. provide complete Gas Cleaning Plants for the removal of dust and fumes from gases resulting from industrial processes and in particular those emanating from cement manufacture, iron and steel production, power generation from solid fossil fuel boilers and municipal incineration.

Lyon & Pye Ltd.
543 Prescot Road, St. Helens, Merseyside WA10 3BZ. Tel: St. Helens 20925. Telex: 627985. Sales Contact: Mr. G. H. Morrison, Sales Manager.

Smokeless Incinerators complying with the requirements of Clean Air Acts for the complete combustion of plastic, rubber and oil wastes.

All units produce hot water which can be used for other purposes.

Mass Transfer Ltd.
124 Highgate, Kendal, Westmorland. Tel: Kendal 24232. Telex: 65145.

May & Baker Ltd.
Dagenham, Essex RM10 7XS. Tel: 01-592 3060. Extn. 363.

This Chemical Manufacturing Company has a specialist Aromatics Division producing a wide range of deodorising compounds for farm and industrial use under the name of 'Alamask'. The company also markets a variety of de-odorants for incorporation into aerosol household polishes, cleaners and insecticides. A staff of odour control technicians is available for consultation to advise on individual problems.

Medical & Biological Instrumentation Ltd.
12/14 Baker Street, London W1M 2HA. Tel: 01-935 0631, 8393. Telex: 261034. Cables: MEDIBI Ashford, Kent.

Suppliers of negative ionisation equipment, particularly for the control of air quality in enclosed spaces.

Range of equipment available for domestic use, offices, factories or computer rooms. Special installations devised for hotel and public service industries.

Ion count advisory specialists.

Midland Oil Refineries Ltd.
Shelah Road, Halesowen, West Midlands B63 3PN. Tel: 021-550 4250.

Midland Oil Refineries Ltd. specialise in the batch re-refining of neat industrial mineral oil lubricants including hydraulic, cutting, quench and others. The re-refined oil is guaranteed to an equivalent of the new oil specification. Also used chlorinated solvents are purchased and redistilled.

MOR Effluent Treatment Company
Shelah Road, Halesowen B63 3PN, West Midlands. Tel: 021-550 4251 (10 lines).

MOR Effluent Treatment Co. manufacture and market a range of easy to operate, economical to use, soluble oil treatment plant. The range includes fully automatic continuous treatment, semi-automatic batch treatment and small portable batch treatment plant. No volume of waste is too large. The treated water can be disposed to sewer and the oil may be reclaimed.

Mine Safety Appliances Co. Ltd.
East Shawhead, Coatbridge ML5 4TD.
Tel: Coatbridge 24966.

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG.
Tel: Leicester 766316/7/8.

Nailsea Engineering Co. Ltd.
The Grange, East Park Road, Blackburn BB1 8AT. Tel: Blackburn 63911.

Manufacturers of dry and wet dust control equipment. The Nailsea range includes "Pnu-Jet" reverse pulse bag filters; variable-throat Venturi scrubbers; and "Rainmaster" wet suppression equipment. Applications particularly in mining, quarrying and road stone preparation. Nailsea installations carry the guarantee that they will cope with the requirements of the Alkali Acts.

Nalfloc Ltd.
P.O. Box No. 11, Northwich, Cheshire CW8 4DX. Tel. Northwich 75301.
Telex: 66-8663.
Local Offices at: Belfast, Bournemouth, Chester-le-Street, Glasgow, Keighley, Leamington Spa, London, Manchester, Scunthorpe, Swansea.

Nalfloc Limited was founded by the association of the former 'Alfloc' Water Treatment Service of ICI Limited and the Nalco Chemical Company.

· Nalfloc provides a wide range of services, equipment and specialty chemicals for water and effluent treatment, for paper making, for the metal industry, for the marine world, and for general process uses throughout industry.

National Carbonising Co. Ltd.
Fullarton Lodge, Crow Hill Drive, Mansfield, Notts. Tel: Mansfield 22644.

National Carbonising Company is the parent company of N.C.C. (Rexco) Ltd., manufacturers of Rexco smokeless fuels—Rexco Multi-Purpose, Rexco Nuts, Rexco Superbrite (Rexcobrite in Scotland), with plants in Nottinghamshire, Leicestershire and at Comrie in Scotland. Also N.C.C. (Coke) Ltd., manufacturers of blast furnace and industrial cokes and domestic Rexcoke, with plants at Barnsley and Rotherham.

Newell Dunford Engineering Ltd.
Newell Dunford House, Portsmouth Road, Surbiton, Surrey KT6 5QF.
Tel: 01-398 4262. Telex: 929574.

A member of the Dunford & Elliott Group.

Newell Dunford Engineering's Thermix line is well known in heavy industry. Shrewd engineers who have to cope with really difficult air pollution problems appreciate the full complement of equipment available which includes: Tubix multitubular centrifugal collectors. Airmix wet collectors, Thermix cloth filter dust arrestors, high temperature filters, dust valves, exhaust fans and pneumatic conveying equipment.

C. A. Norgren Ltd.
Shipston-on-Stour, Warwickshire. Tel: 0608 61676. Telex: 83208.
192-198 Vauxhall Bridge Road, London SW1V 1EF. Tel: 01-834 0891/2.
Telex: 262941.
477 Barlow Moor Road, Chorlton-cum-Hardy, Manchester M21 2AS.
Tel: 061-881 2358. Telex: 668712.

C. A. Norgren Limited. World leading manufacturer of compressed air processing equipment including the new DESIGN CENTRE 'AWARD WINNING' Olympian Plug-in System.

Filters, Pressure Regulators, Air Line Lubricators and associated equipment.

Vacuum Filters, Liquid Filters, Liquid Regulators, CO_2 Regulators.

Fluidic Devices and Systems.

Nu-Way Eclipse Ltd.
P.O. Box 14, Berry Hill, Droitwich, Worcs. Tel: 4242. Telex: 339868.

The vast knowledge and technical expertise gained by NU-WAY ECLIPSE and its associate company in the U.S.A. in incinerating solvents and fumes emitted from a diverse number of industrial processes, has produced fume cleaning plant incorporating the most advanced thinking in the field of thermal incineration and associated heat recovery equipment.

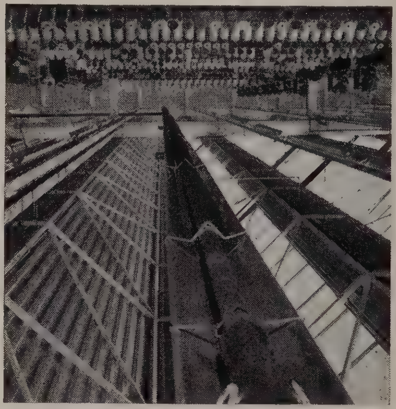
Pathfinder (Environmental) 1974 Ltd.,
Solent Road, Havant, Hampshire PO9 1JF. Tel: Havant 3661/4. Telex: 86332.

Pathfinder (Environmental) 1974 Ltd. are manufacturers of laminar flow clean air cabinets and modules, fume cabinets and associated fans and ducting, close control air conditioning equipment ("Climaticaire") and patient isolators ("Sterair"). They offer a complete design supply and installation service for clean rooms as well as being air conditioning contractors for comfort and specialist applications.

Peabody Holmes Limited,
Turnbridge, Huddersfield HD1 6RB.
Tel: 0484 22222. Telex: 51306.
London: 17/27 Garratt Lane, London SW18 4BY. Tel: 01-874 6491. Telex: 928632.

Peabody Holmes offer total capability in industrial atmospheric pollution control. This means design, manufacture, erection and commissioning of a fully comprehensive range of plant including electrostatic precipitators, high energy scrubbers, wet arrestors, bag filters and multi-cell cyclones. We also supply incinerators for gases, liquids and solids as well as fuel firing equipment for steam raising boilers.

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA. Tel: 01-733 1181.



Nor-Ray-Vac suspended, gas-fired, infra-red radiant space heating system for industrial and commercial buildings features: reliability, high standard of human comfort, flexibility to heat selected areas, ease of installation and future extension, low capital and running costs, freed floor space, safety in hazardous areas, avoidance of condensation and minimum maintenance.

Plastic Constructions Ltd.
Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP. Tel: 021-773 1331 (10 lines). Telex: 338752.

Plastic
CONSTRUCTIONS
GROUP

The Plastic Constructions Group design, manufacture and install in acid-proof corrosion-resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

G. F. Rider (Process Plant) Ltd.
Leeds Place Works, Tollington Park, London N4 3RG. Tel: 01-272 0404/5/6.

Comprehensive waste fired boiler plant, having optional summer time incineration standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

Radiovisor Parent Ltd.
Stanhope Works, High Path, London SW19 2JX. Tel: 01-540 3351. Telex: 928246.

Smoke density measurement and monitoring; smoke detectors for air ducts; dust monitors for burst filter detection; turbidity indicators for flowing liquids.

Rolfite U.K. Ltd.
Debaff House, 56-58 Maypole Road, Ashurst Wood, East Grinstead, Sussex RH19 3QY. Tel: Forest Row 3777/8.

rolfite®

Rolfite products are based on a patented oil-soluble nitrogenous manganese complex, including solutions and dispersions. They are designed to condition oil for more uniform atomisation, improve combustion, reduce corrosion and air pollution by combustion catalyst. Application is simple and operating economies exceed the cost of fuel treatment for any furnace.

Ronald Trist Controls Ltd.
Bath Road, Slough SL1 4DN. Tel: Slough 34646.

Electricon Smoke Density Indicators and Alarms.

A. Schrader's Son, A Division of Scovill Manufacturing
Walkmill Lane, Bridgtown, Cannock, Staffs WS11 3LR. Tel: Cannock 4011. Telex: 336150 Fluid Power Cnk. Cables: Airvalve Cannock.

SCHRADER manufacture a full range of pneumatic equipment for industrial use. Products include air cylinders, control valves, filter, regulator and lubricator equipment, blow guns, quick release couplers and air-line fittings. Blow guns utilise a safety nozzle specially designed to reduce noise, save air and prevent accidents in the event of blockage.

Spencer & Halstead Ltd.
Ossett, West Yorkshire WF5 9AW. Tel: Ossett 5121. Telex: 55201.

SPENSTEAD

Spencer & Halstead, specialists in Air Pollution Control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems and a full filter media service.

Sterling Industrial
Chapeltown, Sheffield S30 4YP. Tel: 0741-5-3171.

Airkem (U.S.A.) odour control equipment and products for industrial plant, sewage works, crematoria, hospitals, washrooms etc., are distributed in the U.K. by Sterling Industrial. The range also includes disinfectants and detergent cleansers with odour counteractant properties. Airkem odour counteractants attack mal-odour molecules in the atmosphere and the interaction of the two result in the reduction of the offensive odour to an acceptable level, both quickly and economically. List of products manufactured by Airkem: Cavalier Solidaire Gels; Sentinel; Sentinel V; Guardian; Guardian 2; Musketeers; Cavalier 2; On Guard; Airkem Wick Bottles and Chloroblocs.

Sturtevant Engineering Co. Ltd.
Hamlyn House, Highgate Hill, London N19 5PP. Tel: 01-272 0233. Telex: 263-206.

Manufacturers of a range of equipment for handling and treating air and fumes emissions.

Electrostatic precipitators specially designed for gas cleaning in power stations, cement works, refuse incinerator plants etc., easily maintained with efficiencies up to 99·99%. "Industrap" modular unit also available for small applications.

Electrostatic air filters ranging from 1 ft^2 area upwards for heating and ventilating and light industrial operations. High efficiencies of up to 99% are obtained. Viscous type air filters and heavy duty washable filter panels.

Oil Mist filters for industrial applications involving oil fume removal with efficiencies of up to 99%.

Multi-cyclone dust and powder collectors which enable the recovery of saleable fines and minimise air pollution—particularly suitable for the food industry.

Comprehensive range of industrial fans including:

S 200 Series Radialine fans with backward aerofoil blades in tubular housing for optimum performance with straight through air flow. Suitable for heating ventilating and industrial applications.

S 400 Series paddle bladed fans for handling materials in powder or granular form.

SE 500 Series Monogram cast iron fans with radial or curved bladed impeller for diverse industrial applications.

SE 1000 Series forward curved fans for many applications requiring high gas flow at low pressure.

S 8000 Series aerofoil bladed fans for a wide range of industrial uses needing high throughput with low power requirements.

Sutcliffe Speakman & Co. Ltd.
Chemical Plant Division, Guest Street, Leigh, Lancs WN7 2HE. Tel: Leigh 72101. Telex: 67555.

Activated carbon equipment; effluent treatment plants and systems; wet scrubbers.

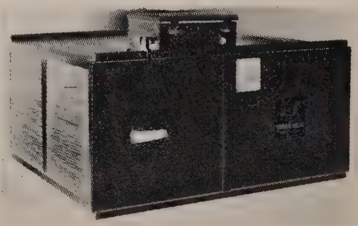
Taylor Servomex Ltd.
Crowborough, Sussex. Tel: Crowborough 2181. Telex: 95113.

Complete range of gaseous oxygen analysers—industrial, research and portable; complete sampling systems; gas chromatography equipment, both process and laboratory, with complete sampling systems; NOx analysers; CO$_2$ and combustible analysers.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire WA14 5EP. Tel: 061-928 4242. (Air Pollution Control Engineers).

Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems filter tubes and screens.

UAS (U.K.) Limited
111 Regent Street, Leamington Spa, Warwickshire CV32 4NU.



Subsidiary of United Air Specialists Inc.; manufacturers of the SMOG-HOG industrial electrostatic air filter and air pollution control systems. Self-contained and modular precipitators from 600 c.f.m.-24,000 c.f.m.

Vokes Ltd.
Henley Park, Guildford, Surrey GU3 2AF. Tel: 0483 69971. Telex: 85235 Vokesacess Guildford.

Manufacturers of comprehensive range of air and liquid filters, pipe supports and expansion bellows.

Wellman Incandescent Ltd.
Cornwall Road, Smethwick, Warley, W. Midlands B66 2LB. Tel: 021-558 3151.

Incinerators for gaseous fumes (catalytic and thermal). Incinerators: waste, pathological, municipal, animal, plus special applications.

Dust arresters and sludge removal for cupola melting plants. Cupolas, furnaces, kilns, ovens designed to meet the latest requirements.

Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.
Capitol House, Church Street, Epsom, Surrey. Tel: Epsom 27661. Telex: 23704.

Western Precipitation is part of an international organisation and concentrates on the design, manufacture and installation of electrical precipitators, mechanical dust collectors, dust valves, bag filters and wet scrubbers.

Wimpey Laboratories Ltd.
Beaconsfield Road, Hayes, Middlesex UB4 0LS. Tel: 01-573 7744. Telex: UK 25666; Overseas 22436. Telegrams and Cables: Wimpeylab Hayes.

WIMPEY LABORATORIES LIMITED
Springfield Road, Hayes, Middlesex
Tel: 01-573 7744

Wimpey Laboratories offer a noise and vibration measuring and advisory service which is operated by engineers and physicists whose long experience in this field has been gained by dealing with quality control and design problems in Wimpey and other contracts.

Surveys dealing with pollution of the environment, other than noise, are also undertaken.

Diana Wyllie Ltd.
3 Park Road, Baker Street, London NW1. Tel: 01-723 7333/3330.
"The Air You Breathe" with notes by Rear Admiral P. G. Sharp.
"Air Pollution", parts 1 and 2, by Professor R. S. Scorer.
"Water Pollution", parts 1 and 2, by J. Ian Waddington.
"Energy Conservation", parts 1 and 2, by P. G. Sharp.
"Waste and Re-Cycling" by Tom Burke.

All with full lecture notes; some with cassette commentary.

John Zink Co. Ltd.
Acrewood Way, St. Albans, Herts. Tel: St. Albans 61451. Telex: 265930. Head Office: Tulsa, USA, with offices also in France, Germany, Italy, Australia, South Africa, Spain, Holland, Japan.

Designers and manufacturers of burners, flares, automatic control systems, thermal oxidiser systems, solids, incinerators and associated equipment for the petroleum, petrochemical and process industries.

CLASSIFIED ENTRIES

Acoustic Contractors
Allaway Acoustics Ltd.
Industrial Acoustics Co. Ltd.

Activated Carbon Equipment
Sutcliffe, Speakman & Co. Ltd.

Activated Carbons
Sutcliffe, Speakman & Co. Ltd.

Aerators
Harleyford Hydrosand Equipment Co. Ltd.

Air Conditioners (Domestic)
John Bass Ltd.
Felvic Group Ltd.
Medical & Biological Instrumentation Ltd.

Air Conditioning Equipment
AAF Ltd.
John Bass Ltd.
Felvic Group Ltd.
Medical & Biological Instrumentation Ltd.
Pathfinder (Environmental) 1974 Ltd.

Air Disinfecting Products
Bacterol Ltd.

Air Freshener Spray Fluids
Bacterol Ltd.

Air Movers
F. Brauer Ltd.

Air Pollution Measurement
Analysis Automation Ltd.
C. F. Casella & Co. Ltd.
Charles Austen Pumps Ltd.
The Counties Public Health Laboratories (Thresh, Beale & Suckling) Ltd.
Fleming Instruments Ltd.
International Environmental Bureau for the Non-Ferrous Industries.
Lodge-Cottrell Ltd.
Medical & Biological Instrumentation Ltd.

Air Sterilisation
Pathfinder (Environmental) 1974 Ltd.

Analysis Apparatus: Gases
Analysis Automation Ltd.
Taylor Servomex Ltd.

Analysis Apparatus: Noise/Vibration
Castle Associates.

Analysis Apparatus: Particles/Powders
Medical & Biological Instrumentation Ltd.

Analysis Apparatus: Water
Analysis Automation Ltd.
Nalfloc Ltd.

Anti-Soot and Corrosion Treatment
Nalfloc Ltd.

Automatic Control Equipment
C. A. Norgren Ltd.
Peabody Holmes Ltd.
John Zink Co. Ltd.

Bacteria Sampling Equipment
C. F. Casella & Co. Ltd.

Bifurcated Fans (PVC & Polypropylene)
Pathfinder (Environmental) 1974 Ltd.
Plastic Constructions Ltd.

Blowers
Peabody Holmes Ltd.

Boiler Feedwater Treatment
The Counties Public Health Laboratories (Thresh, Beale & Suckling) Ltd.
Nalfloc Ltd.

Boilers: Domestic
Ideal-Standard Ltd.

Boilers: Industrial
Babcock & Wilcox (Operations) Ltd.

Boilers: Industrial, Solid Fuel
Babcock & Wilcox (Operations) Ltd.

Boilers: Industrial, Waste-Fired
Babcock & Wilcox (Operations) Ltd.
G. F. Rider (Process Plant) Ltd.

Boilers: Packaged, Oil-Fired
Babcock & Wilcox (Operations) Ltd.

Brickwork, Boiler Setting
G. F. Rider (Process Plant) Ltd.

Burners: Gas
Auto Combustions (London) Ltd.
Babcock & Wilcox (Operations) Ltd.

Nu-Way Eclipse Ltd.
Peabody Holmes Ltd.
John Zink Co. Ltd.

Burners: Oil
Auto Combustions (London) Ltd.
Babcock & Wilcox (Operations) Ltd.
Nu-Way Eclipse Ltd.
Peabody Holmes Ltd.
John Zink Co. Ltd.

Burners: Solid Fuel
Babcock & Wilcox (Operations) Ltd.
Peabody Ltd.

Burners: Waste-Fired
Nu-Way Eclipse Ltd.

Canopy Hood
Plastic Constructions Ltd.

Catalytic Air Pollution Control Units
Johnson Matthey Chemicals Ltd.

Ceilings: Heated
Phoenix Burners Ltd.

Centrifugal Fans (PVC and Polypropylene)
Plastic Constructions Ltd.

Chimneys
F. E. Beaumont Ltd.

Clean Rooms
John Bass Ltd.
Constant Air Systems Ltd.
Modern Air Systems (Leicester) Ltd.
Pathfinder (Environmental) 1974 Ltd.

Combustion Catalysts
Nalfloc Ltd.

Compressed Air Filters
C. A. Norgren Ltd.

Contractors: Heating/Ventilating & Air Conditioning
Carrier Air Conditioning (UK) Ltd.
Constant Air Systems Ltd.
Medical & Biological Instrumentation Ltd.
Pathfinder (Environmental) 1974 Ltd.

Controllers: Analytical & Research
Taylor Servomex Ltd.

Controllers: Gas Pressure
C. A. Norgren Ltd.

Controllers: Liquid Level
Auriema Ltd.
C. A. Norgren Ltd.

Controllers: Noise
Castle Associates.

Controllers: pH
Analysis Automation Ltd.

Controllers: Temperature
Taylor Servomex Ltd.

Cyclones
F. E. Beaumont Ltd.
Buell Ltd.
C. F. Casella & Co. Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dampers: Gas-Tight
Lodge-Cottrell Ltd.

Detectors: Explosive Gases
Analysis Automation Ltd.

Detectors: Dust
C. F. Casella & Co. Ltd.

Detectors: SO_2
Analysis Automation Ltd.
C. F. Casella & Co. Ltd.

Detectors: Toxic Gases
Analysis Automation Ltd.

Detectors: Toxic Gases (H_2S)
Fleming Instruments Ltd.

Discharge Valves
Buell Ltd.
Plastic Constructions Ltd.

Distillation Equipment
Sutcliffe, Speakman & Co. Ltd.

Duct Heaters
John Zink Co. Ltd.

Ducting
Carter Industrial Products Ltd., Midac Dust Control Division.
Modern Air Systems (Leicester) Ltd.
Plastic Constructions Ltd.

Dust Classification Plant
Buell Ltd.
Nailsea Engineering Co. Ltd.

Dust Collection Equipment
Carter Industrial Products Ltd., Midac Dust Control Division.
Collectron (Dust Control) Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.

Dust Collection Equipment & Plant
AAF Ltd.
Airmaster Engineering Ltd.
Buell Ltd.
Carter Industrial Products Ltd., Midac Dust Control Division.
Collectron (Dust Control) Ltd.
Constant Air Systems Ltd.
Lodge-Cottrell Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Spencer & Halstead Ltd.
Sturtevant Engineering Co. Ltd.

Dust Collectors
F. E. Beaumont Ltd.
Carter Industrial Products Ltd., Midac Dust Control Division.
Collectron (Dust Control) Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.
Sturtevant Engineering Co. Ltd.
Tilghman Wheelabrator Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dust Collector Filter Media
Bury & Masco Industries Ltd.
Carter Industrial Products Ltd., Midac Dust Control Division.
Modern Air Systems (Leicester) Ltd.
Spencer & Halstead Ltd.

Dust Sampling Equipment
C. F. Casella & Co. Ltd.
Fleming Instruments Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dust Suppression Equipment
Nailsea Engineering Co. Ltd.

Effluent Treatment Media
Mass Transfer Ltd.

Effluent Treatment: Plant/Systems
The Counties Public Health Laboratories (Thresh, Beale & Suckling) Ltd.
Harleyford Hydrosand Equipment Co. Ltd.
Head Wrightson Process Engineering Ltd.
Mass Transfer Ltd.

Effluent Treatment: Soluble Oil Plant
MOR Effluent Treatment Co.

Electrostatic Precipitators
AAF Ltd.
Lodge-Cottrell Ltd.
Peabody Holmes Ltd.
Sturtevant Engineering Co. Ltd.

Electrostatic Unit Air Cleaners
Bel Sound Products Co.

Fabric Filters
AAF Ltd.
Buell Ltd.
Bury & Masco Industries Ltd.
Carter Industrial Products Ltd., Midac Dust Control Division.
Head Wrightson Process Engineering Ltd.
Lodge-Cottrell Ltd.
Modern Air Systems (Leicester) Ltd.
Peabody Holmes Ltd.
Tilghman Wheelabrator Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Fans & Blowers
Medical & Biological Instrumentation Ltd.
Modern Air Systems (Leicester) Ltd.
Plastic Constructions Ltd.
Sturtevant Engineering Co. Ltd.
Tilghman Wheelabrator Ltd.

Filter Paper
Evans, Adlard & Co. Ltd.

Filters
Carter Industrial Products Ltd., Midac Dust Control Division.
Sturtevant Engineering Co. Ltd.

Filters: Air
AAF Ltd.
John Bass Ltd.
Felvic Group Ltd.
Mine Safety Appliances Co. Ltd.
Nailsea Engineering Co. Ltd.
Pathfinder (Environmental) 1974 Ltd.

A. Schrader's Son: A Division of Scovill Manufacturing.
Spencer & Halstead Ltd.
Sturtevant Engineering Co. Ltd.
Vokes Ltd.

Filters: Dust
AAF Ltd.
Carter Industrial Products Ltd., Midac Dust Control Division.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Spencer & Halstead Ltd.
Sturtevant Engineering Co. Ltd.

Filters: Electrostatic Oil Mist
U.A.S. (UK) Ltd.
Sturtevant Engineering Co. Ltd.

Filters: Water
Harleyford Hydrosand Equipment Co. Ltd.
Vokes Ltd.

Flares
John Zink Co. Ltd.

Flue Dust Extraction Plant
Head Wrightson Process Engineering Ltd.
Modern Air Systems (Leicester) Ltd.
Peabody Holmes Ltd.

Flue Gas Dust Monitoring Device (CEGB Type)
Airflow Developments Ltd.

Flue Gas Dust Sampling Equipment (BCURA Type)
Airflow Developments Ltd.
International Environmental Bureau for the Non-Ferrous Industries.

Flue Gas Treatment
Lodge-Cottrell Ltd.
Mass Transfer Ltd.
Peabody Holmes Ltd.
Sturtevant Engineering Co. Ltd.

Fuel Additives
Nalfloc Ltd.
Rolfite U.K. Ltd.

Fuel Oil Combustion Improver
Nalfloc Ltd.

Fuel: Electricity Supply
The Electricity Council.

Fuels: Solid Smokeless
Coalite and Chemical Products Ltd.
National Carbonising Co. Ltd.

Fume Removal Equipment
AAF Ltd.
F. Brauer Ltd.
Carter Industrial Products Ltd., Midac Dust Control Division.
Constant Air Systems Ltd.
Head Wrightson Process Engineering Ltd.
Lodge-Cottrell Ltd.
Modern Air Systems (Leicester) Ltd.
Peabody Holmes Ltd.
Plastic Constructions Ltd.
Spencer & Halstead Ltd.
Sturtevant Engineering Co. Ltd.

Furnaces, Ovens, Kilns, etc.
Auto Combusutions (London) Ltd.
R. M. Catterson-Smith Ltd.
International Environmental Bureau for the Non-Ferrous Industries
G. F. Rider (Process Plant) Ltd.

Gas Cleaning Plant
AAF Ltd.
Buell Ltd.
Collectron (Dust Control) Ltd.
Head Wrightson Process Engineering Ltd.
Lodge-Cottrell Ltd.
Mass Transfer Ltd.
Nailsea Engineering Co. Ltd.
Peabody Holmes Ltd.
Sturtevant Engineering Co. Ltd.
Western Precipitation Division of Joy Manufacturing Co. (UK) Ltd.

Gas Heating Equipment (Butane/Propane)
Phoenix Burners Ltd.

Gas Scrubbers & Washers
Buell Ltd.
Collectron (Dust Control) Ltd.
Head Wrightson Process Engineering Ltd.
Lodge-Cottrell Ltd.
Mass Transfer Ltd.
Peabody Holmes Ltd.
Plastic Constructions Ltd.
Western Precipitation Division of Joy Manufacturing Co. (UK) Ltd.

Grit Arresters
F. E. Beaumont Ltd.
Peabody Holmes Ltd.
Sturtevant Engineering Co. Ltd.

Heat Exchangers
Alfa-Laval Co. Ltd.
Auto Combustions (London) Ltd.
Babcock & Wilcox (Operations) Ltd.

Heaters: Air
John Zink Co. Ltd.

Heaters: Infra-Red
Phoenix Burners Ltd.

Humidifiers
Felvic Group Ltd.

Incandescent/Whiting Wet Arrestor for Cupolas
Wellman Incandescent Ltd.

Incinerators
Babcock & Wilcox (Operations) Ltd.
Geldia (London) Ltd.
Johnson Matthey Chemicals Ltd.
Lyon & Pye Ltd.
Peabody Holmes Ltd.
G. F. Rider (Process Plant) Ltd.
Wellman Incandescent Ltd.
John Zink Co. Ltd.

Indicators: Flow
Auriema Ltd.
C. F. Casella & Co. Ltd.

Indicators: Humidity
Auriema Ltd.
C. F. Casella & Co. Ltd.

Indicators: SO_2
C. F. Casella & Co. Ltd.

Indicators: Sound Level
Castle Associates.

Instruments: Gauges, Meters, etc.
Babcock & Wilcox (Operations) Ltd.
Felvic Group Ltd.

Insulation: Acoustics
Allaway Acoustics Ltd.
Wimpey Laboratories Ltd.

Ion Exchange
Medical & Biological Instrumentation Ltd.
Nalfloc Ltd.

Laboratory Fume Cabinets
Pathfinder (Environmental) 1974 Ltd.
Plastic Constructions Ltd.

Lectures, Filmstrip/Slide Sets & Notes
Diana Wyllie Ltd.

Masking Agents
Bacterol Ltd.

Meteorological Instruments
C. F. Casella & Co. Ltd.

Monitoring Equipment
Analysis Automation Ltd.
C. F. Casella & Co. Ltd.
Fleming Instruments Ltd.
International Environmental Bureau for the Non-Ferrous Industries.

Noise Control Materials
Industrial Acoustics Co. Ltd.

Noise Suppression
Allaway Acoustics Ltd.
Castle Associates.
Industrial Acoustics Co. Ltd.
International Environmental Bureau for the Non-Ferrous Industries.

Noise/Vibration Attenuation
AAF Ltd.
Allaway Acoustics Ltd.
Castle Associates.
Industrial Acoustics Co. Ltd.
Wimpey Laboratories Ltd.

Noise/Vibration: Control Engineers
Allaway Acoustics Ltd.
Castle Associates.
Industrial Acoustics Co. Ltd.
Wimpey Laboratories Ltd.

Noise/Vibration: Control Systems
Allaway Acoustics Ltd.
Castle Associates.
Industrial Acoustics Co. Ltd.

Noise/Vibration: Measuring Equipment
Castle Associates.

Noise/Vibration: Protective Devices
Castle Associates.
Industrial Acoustics Co. Ltd.

Odour Absorption
Carter Industrial Products Ltd., Midac Dust Control Division.
Mass Transfer Ltd.

Odour Control
Bacterol Ltd.
Carter Industrial Products Ltd.,
Midac Dust Control Division.
Mass Transfer Ltd.
May & Baker Ltd.
Sterling Industrial.
Sutcliffe, Speakman & Co. Ltd.

Oil Dispersants
Nalfloc Ltd.

Oil Re-refining
Midland Oil Refineries Ltd.

Pipeline Equipment & Services
Plastic Constructions Ltd.

Pollution Control Advisory Services
The Counties Public Health Laboratories (Thresh, Beale & Suckling) Ltd.
International Environmental Bureau for the Non-Ferrous Industries
Medical & Biological Instrumentation Ltd.
Nalfloc Ltd.

Process Instrumentation
Analysis Automation Ltd.

Publications
Diana Wyllie Ltd.

Pumps
C. F. Casella & Co. Ltd.
Charles Austen Pumps Ltd.
Lee, Howl & Co. Ltd.
Plastic Constructions Ltd.

Radiant Heating
Phoenix Burners Ltd.

Re-odourant Sprays
Bacterol Ltd.

Research & Development Facilities
Head Wrightson Process Engineering Ltd.
International Environmental Bureau for the Non-Ferrous Industries.
Lodge-Cottrell Ltd.
Wimpey Laboratories Ltd.

Roof Ventilators (PVC)
Plastic Constructions Ltd.

Scrubbers
Buell Ltd.
Carter Industrial Products Ltd.,
Midac Dust Control Division
Collectron (Dust Control) Ltd.
Lodge-Cottrell Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Plastic Constructions Ltd.
Western Precipitation Division of Joy Manufacturing Co. (UK) Ltd.

Sleeves & Tubes (for Fabric Filters)
Bury & Masco Industries Ltd.
G. F. Rider (Process Plant) Ltd.
Tilghman Wheelabrator Ltd.

Smoke Density Gauges & Meters
Radiovisor Parent Ltd.

Smoke Indicators
Airflow Developments Ltd.
Ronald Trist Controls Ltd.

Smut Inhibitors
Nalfloc Ltd.

Solvent Recovery
Midland Oil Refineries Ltd.

Solvent Recovery Plant
Sutcliffe, Speakman & Co. Ltd.

Spraying Apparatus for Deodorants etc.
Bacterol Ltd.

Stokers: Industrial
Babcock & Wilcox (Operations) Ltd.

Tanks and Tank Linings
Plastic Constructions Ltd.

Thermometers
Auriema Ltd.

Towers
Plastic Constructions Ltd.

Ultra-Violet Recording System
Fleming Instruments Ltd.

Unit Dust Collectors
AAF Ltd.
Carter Industrial Products Ltd.,
Midac Dust Control Division.
Modern Air Systems (Leicester) Ltd.
Spencer & Halstead Ltd.
Tilghman Wheelabrator Ltd.

Ventilators
Plastic Constructions Ltd.

Warm Air Heating Systems
Constant Air Systems Ltd.

Waste Heat Recovery
Babcock & Wilcox (Operations) Ltd.
Head Wrightson Process Engineering Ltd.
Peabody Holmes Ltd.
G. F. Rider (Process Plant) Ltd.

Waste Fuel Boiler Plant
G. F. Rider (Process Plant) Ltd.

Waste Material Disposal Furnaces
Peabody Holmes Ltd.
G. F. Rider (Process Plant) Ltd.
John Zink Co. Ltd.

Wet Arresters
Carter Industrial Products Ltd.,
Midac Dust Control Division.
Collectron (Dust Control) Ltd.
Lodge-Cottrell Ltd.
Modern Air Systems (Leicester) Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Spencer & Halstead Ltd.
Tilghman Wheelabrator Ltd.

DIRECTORY OF ORGANIZATIONS

with Air Pollution Interests

GREAT BRITAIN

ARTS, ARCHITECTURE AND TOWN PLANNING

Building Centre, The, 26 Store Street, London WC1E 7BT. (01-637 1022: Administration) Telex: 261446 (01-637 4522: Information).

Building Research Establishment, Building Research Station, Garston, Watford WD2 7JR. (Garston (Herts) 74040). Fire Research Station, Borehamwood, Herts WD6 2BL. (01-953 6177). Princes Risborough Laboratory, Princes Risborough, Aylesbury, Bucks. (Princes Risborough 3101).

Civic Trust, 17 Carlton House Terrace, London SW1Y 5AW (01-930 0914).

Housing Centre Trust, 62-65 Chandos Place, London WC2N 4HH (01-240 3424).

Incorporated Association of Architects and Surveyors, 29 Belgrave Square, London SW1X 8QF (01-235 3755/7).

Institution of Civil Engineers, Great George Street, London SW1P 3AA (01-839 3611).

Institute of Housing Managers, Victoria House, Southampton Row, London WC1B 4EB. (01-242 3267/8).

Institution of Municipal Engineers, 25 Eccleston Square, London SW1V 1NX. (01-834 5082/3).

International Institute for Conservation of Historic & Artistic Works, 608 Grand Buildings, Trafalgar Square, London WC2N 5HN. (01-839 5975).

National Housing and Town Planning Council Incorporated, 11 Green Street, London W1Y 4ES. (01-629 7107/8).

Royal Institute of British Architects, 66 Portland Place, London W1N 4AD. (01-580 5533).

Royal Society of Arts, 6-8 John Adam Street, London WC2N 6EZ. (01-839 2366).

Royal Town Planning Institute, 26 Portland Place, London W1N 4BE. (01-636 9107/8/9).

Society for the Protection of Ancient Buildings, 55 Great Ormond Street, London WC1N 3JA. (01-405 2646).

Structural Insulation Association, Audley House, 9 Margaret Street, London W1N 7LF. (01-637 7031).

Town and Country Planning Association, 17 Carlton House Terrace, London SW1Y 5AS (01-930 8903).

CLEAN AIR

HM Alkali and Clean Air Inspectorate:
Chief Inspector, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London, SW1H 9JW (01-930 4300, ext. 76).
Deputy Chief Inspectors, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London, SW1H 9JW (01-930 4300, ext. 54, 61 and 541).
Chief Inspector for Northern Ireland, M. D. Hinchliff, Government of Northern Ireland, Ministry of Development, Alkali and Radiochemical Inspectorate, Stormont, Belfast, BT4 3SS (0232 63210).
Chief Inspector for Scotland, HM Industrial Pollution Inspectorate for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY (031-226 5208).

Clean Air Council, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London SW1H 9JU (01-930 4300, ext. 472).

Clean Air Council for Scotland, Scottish Development Department, Room E1/233, Government Buildings, Broomhouse Drive, Saughton, Edinburgh EH11 4XR (031-443 4040, ext. 327).

Derbyshire Advisory Council for Clean Air and Noise Control, Town Clerk's Office, Town Hall, Chesterfield (0246-77232).

The Greater Manchester Council for Clean Air and Noise Control, Environmental Health Department, Town Hall, Manchester M60 2JS (061-236 3377, ext. 2591/2).

Institution of Chemical Engineers, 15 Belgrave Square, London SW1X 8PT (01-235 3647).

Institute of Petroleum, Atmospheric Pollution Committee, Secretary: P. Jones, 61 New Cavendish Street, London W1M 8AR (01-636 1004).

Midlands Joint Advisory Council for Clean Air and Noise Control, Public Health Department, Darwall Street, Walsall WS1 1DJ (Walsall 21244).

National Society for Clean Air
Central Offices: 136 North Street, Brighton, BN1 1RG (Brighton 26313).
Scottish Division: Town Clerk's office, 78 Cochrane Street, Glasgow G2 1DU (041 221-9600, ext. 2538).
Northern Ireland Division: 20 Kensington Gardens, Belfast BT5 6NP (Castlereagh 461).
Northern Division: Health and Social Services Dept., Civic Centre, Barras Bridge, Newcastle upon Tyne (Newcastle upon Tyne 28520).
North West Division: 129 Chorley Road, Swinton, Manchester M27 2AD (061 794-4711, ext. 293).
Yorkshire Division: Municipal Buildings, Pontefract, Yorkshire (Pontefract 72383).
West Midlands Division: Environmental Health Dept., P.O. Box 14, Council House, Halesowen B63 3AF (021-550 1651).
East Midlands Division: Health Dept., Castlefield House, Main Centre, Derby (Derby 31111).
London and South East Division and Central Southern Division: Town Hall, Bath Road, Slough SL1 3UG (0753 23881).
South West Division: Environmental Health Dept., Union House, Union Street, Bristol BS1 2DN (0272 26241).
South and Mid Wales: 9 Lodge Drive, Baglan, Port Talbot (Port Talbot 5231).

Royal Institute of Chemistry, 30 Russell Square, London WC1B 5DT (01-580 3482).

Teesside Clean Air and Noise Abatement Committee, Secretary's Department Langbaurgh Town Hall, Fabian Road, South Bank, Middlesbrough, Cleveland TS6 9AR (06495 2591).

Warwickshire Environmental Protection Council, c/o Warwick District Council, Town Hall, Leamington Spa, Warwickshire (0926 27072).

Yorkshire and Humberside Advisory Council for Clean Air and Noise Control, J. A. Hinchliffe, Environmental Health Department, Municipal Offices, Pontefract, Yorkshire Pontefract 3161).

FUEL AND ENERGY

B.P. Marketing Limited, P.O. Box No. 148, Shell-Mex House, Strand, London WC2R 0DX (01-836 1234).

British Carbonization Research Association, Chesterfield, Derbys (Chesterfield 76821).

British Gas Corporation, The, 59 Bryanston Street, Marble Arch, London W1A 2AZ. (01-723 7030).

Central Electricity Generating Board, Sudbury House, 15 Newgate Street, London EC1A 7AU (01-248 1202).

College of Fuel Technology, 90 Talbot Road, Highgate, London N6 4RB (01-340 6972).

Combustion Engineers Association, Beaufort Chambers, 240B High Street, Slough, Bucks. (Slough 33211).

Domestic Solid Fuel Appliances Approval Scheme, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020, ext. 31).

Electrical Association for Women, 25 Foubert's Place, London W1V 2AL (01-437 5212/3).

Electrical Research Association, Cleeve Road, Leatherhead, Surrey (Leatherhead 74151). Telex 264045.

Electricity Council, 30 Millbank, London SW1P 4RD (01-834 2333).

Esso Petroleum Co. Ltd., Victoria Street, London S.W.1. (01-834 6677).

Institute of Fuel, 18 Devonshire Street, London W1N 2AU (01-580 7124).

Institution of Electrical Engineers, Savoy Place, London WC2R OBL (01-240 1871).

Institution of Gas Engineers, 17 Grosvenor Crescent, London SW1X 7ES (01-245 9811).

Institution of Heating and Ventilating Engineers, 49 Cadogan Square, London SW1X 0JB (01-235 7671/2/3).

Low Temperature Coal Distillers' Association of Great Britain Ltd., P.O. Box No. 21, Chesterfield, Derbyshire (0246 822281/9).

National Coal Board, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020).

NIFES (National Industrial Fuel Efficiency Service Ltd.).
Registered office:
54/58 Bartholomew Close, London, EC1A 7HD (01-606 5906).
Offices:
84 High Street, Buntingford, Herts. SG9 9AG (0763 71154).
88 Cathedral Road, Cardiff, CF1 9LN (0222 33825).
Wellington House, 190, Derby Road, Nottingham, NG7 1NR (0602 44753).
26 Calthorpe Road, Edgbaston, Birmingham, B15 1RP (021-454 4471).
N.I.F.E.S. House, Sinderland Road, Broadheath, Altrincham. Cheshire, WA14 5HQ (061-928 5791).
Rawdon House, Green Lane, Yeadon, Nr. Leeds LS19 7BY (09737 5943).
26 Portland Terrace, Jesmond, Newcastle upon Tyne, NE2 1QJ (0632 813776).
6 Park Terrace, Glasgow, G3 6BY (041-332 2453).
49 Meadowside, Dundee, DD1 1EQ (0382 22179).

Shell Marketing Limited, P.O. Box No. 148 Shell-Mex House, Strand, London WC2R 0DX (01-836 1234).

Society of British Gas Industries, 56-58 Holly Walk, Leamington Spa, Warwickshire (Leamington Spa 34357).

Solid Smokeless Fuels Federation, York House, Empire Way, Wembley, Middlesex HA9 0PA (01-902 5405).

Women's Solid Fuel Council, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020).

Women's Gas Federation and Young Homemakers, Gaywood House, 29 Great Peter Street, London SW1P 3LW (01-222 3677/0).

GENERAL

City and Guilds of London Institute, 76 Portland Place, London W1N 4AA (01-580 3050).

National Council of Women of Great Britain, The, 36 Lower Sloane Street, London SW1W 8BP (01-730 0619).

National Council of Social Service, The, 26 Bedford Square, London WC1B 3HU (01-636 4066).

Royal Institution of Great Britain, 21 Albemarle Street, London W1X 4BS (01-493 0669 and 5716).

GENERAL ENVIRONMENT AND CONSERVATION BODIES

Committee for Environmental Conservation, 29-31 Greville Street, London EC1N 8AX (01-242 9647).

Conservation Society, 12 London Street, Chertsey, Surrey KT16 8AA (Chertsey 60975).

Council for the Protection of Rural England, 4 Hobart Place, London SW1W OHY (01-235 9481).

Council for the Protection of Rural Wales (Cymdeithas Diogelu Harddwych Cymru), Meifod, Powys SY22 6DA (Meifod 383).

Countryside Commission, John Dower House, Crescent Place, Cheltenham, Glos GL50 3RA (0242 21381).

Environmental Science Research Unit, College of Aeronautics, Cranfield Institute of Technology, Cranfield, Bedford (Bedford (0234) 750111).

National Trust for Places of Historical Interest or Natural Beauty, 42 Queen Anne's Gate, London S.W.1 (01-930 0211).

Royal Commission on Environmental Pollution, Church House, Great Smith Street, London SW1P 3BL (01-222 6991).

GOVERNMENT AND LOCAL BODIES

Association of County Councils in Scotland, 3 Forres Street, Edinburgh (031-225 1626/7).

Association of District Councils (represents all of the new 333 district councils in England and Wales), 25 Buckingham Gate, London SW1E 6LE (01-828 7425).

Association of Metropolitan Authorities, 36 Old Queen Street, Westminster, London SW1H 9JE (01-930 9861).

Atomic Energy Research Establishment, Harwell, Didcot, Oxon OX11 0RA (Abingdon 4141).

Association of County Councils, Eaton House, 66A Eaton Square, Westminster SW1W 9BH (01-235 5173).

Department of the Environment, 2 Marsham Street, London SW1P 3EB (01-212 3434).
Clean Air Division: Queen Anne's Chambers, 28 Broadway, London SW1H 9JU (01-930 4300).
(Also see Alkali and Clean Air Inspectorate).

Department of Energy, Thames House South, Millbank, London SW1 4QJ (01-222 7000).

Department of Industry, Industrial and Commercial Policy Division, 1 Victoria Street, London SW1H 0ET (01-222 7877).

Her Majesty's Stationery Office, Atlantic House, Holborn Viaduct, London EC1P 1BN (01-248 9876), and at Sovereign House, St. Georges Street, Norwich NOR 76A (Norwich 22211).

London Boroughs Association, Westminster City Hall, Victoria Street, London SW1E 6QW (01-828 8070).

Parliamentary and Scientific Committee, 14 Buckingham Palace Road, London SW1W 0QP (01-834 2608).

Scottish Counties of Cities Association (dissolved 15.5.1975), City Chambers, Edinburgh EH1 1YJ (031-225 2424).

Scottish Development Department, Room F1/247, Government Buildings, Broomhouse Drive, Saughton, Edinburgh EH11 4XR (031-443 4040, ext. 397).

Standing Conference of Co-operating Bodies, Warren Spring Laboratory (Department of Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

Warren Spring Laboratory (Department of Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

HEALTH

Association of Public Health Inspectors, 19 Grosvenor Place, London SW1X 7HU (01-235 5158/9).

British Medical Association, B.M.A. House, Tavistock Square, London WC1H 9JP (01-387 4499).

Department of Health and Social Security, Alexander Fleming House, Elephant and Castle, London SE1 6BY (01-407 5522).

Health Education Council, 78 New Oxford Street, London WC1A 1AH (01-637 1881).

Institute of Hospital Engineering, 20 Landport Terrace, Southsea, Hampshire PO1 2RG (0705 23186).

Institution of Public Health Engineers, 32 Eccleston Square, London SW1V 1PB (01-834 3017).

Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical College, Charterhouse Square, London EC1M 6BQ (01-253 1537).

Royal Institute of Public Health and Hygiene, 28 Portland Place, London W1N 4DE (01-580 2731/2).

Royal Sanitary Association of Scotland, The, Bank of Scotland Building, 224 Ingram Street, Glasgow G1 1HH (041-248 7955).

Royal Society of Health, 13 Grosvenor Place, London SW1X 7EN (01-235 9961/5).

Society of Community Medicine, Tavistock House South, Tavistock Square, London WC1H 9LD (01-387 3923).

INDUSTRY, INSTRUMENTS AND STANDARDS

British Industrial Measuring and Control Apparatus Manufacturers' Association, 20 Peel Street, London W8 7PD (01-727 2614).

British Oil and Gas Firing Equipment Manufacturers' Association, The Fernery, Market Place, Midhurst, Sussex GU29 9DP (073081 2782).

British Standards Institution, British Standards House, 2 Park Street, London W1A 2BS (01-629 9000).

Confederation of British Industry, 21 Tothill Street, London SW1H 9LP (01-930 6711).

Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ (01-839 1211).

Institution of Plant Engineers, 138 Buckingham Palace Road, London SW1W 9SG (01-730 0469).

Scientific Instrument Manufacturers' Association of Great Britain, 20 Peel Street, London W8 7PD (01-727 2614).

Sira Institute Ltd., South Hill, Chislehurst, Kent (01-467 2636).

IRON AND STEEL

British Cast Iron Research Association, Alvechurch, Birmingham B48 7QB (Redditch 66414). Telex: 337 125.

British Independent Steel Producers Association, 5 Cromwell Road, London SW7 2HX (01-581 0231).

British Steel Corporation, P.O. Box 403, 33 Grosvenor Place, London SW1X 7JG (01-235 1212).

Council of Ironfoundry Associations, 14 Pall Mall, London SW1Y 5LZ (01-930 7171).

Institution of Corrosion Technology, The, 14 Belgrave Square, London SW1X 8PS (01-245 9189).

Steel Castings Research and Trade Association, East Bank Road, Sheffield S2 3PT (0742 28647).

METEOROLOGY

Meteorological Office, London Road, Bracknell, Berkshire (0344 20242).

Meteorological Office, Weather Centres
Forecasts, London: 01-836 4311
Glasgow: 041-248 3451
Manchester: 061-832 6701
Newcastle: 0632 26453
Southampton: 0703 28844
Nottingham (Watnall): 060-75 3311.

Royal Meteorological Society, Cromwell House, High Street, Bracknell, Berks. (Bracknell 22957).

TRANSPORT

British Internal Combustion Engine Research Institute Ltd., 111-112 Buckingham Avenue, Slough, Bucks SL1 4PH (Slough 27371).

Institute of Road Transport Engineers, The, 1 Cromwell Place, Kensington, London SW7 2JF (01-589 3744).

Motor Industry Research Association, The, Watling Street, Nuneaton, Warwickshire (Nuneaton 68541).

Road Haulage Association Ltd., The, 22 Upper Woburn Place, London WC1H 0ES (01-387 9711).

OVERSEAS

Argentine
*Asociación Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires.

Australia
Clean Air Society of Australia and New Zealand, Box 100, P.O., Lane Cove, 2066, New South Wales.
Air Pollution Control Branch, N.S.W. Department of Health, P.O. Box 163, Lidcombe, N.S.W. 2141.
Commonwealth Scientific and Industrial Research Organisation, P.O. Box 225, Dickson A.C.T. 2602.
Department of Public Health, Box 65, Rundle Street, P.O., Adelaide, S.A. 5000.
Division of Air Pollution Control, Department of Health, 484 Adelaide St., Brisbane, Qld. 4000.
Environmental Control, Department of Labour and Industry, 81 Brisbane St., Hobart, Tas. 7000.
Environment Protection Authority, 232 Victoria Pde., East Melbourne, Vic.
Department of Public Health, 57 Murray St., Perth, W.A. 6000.

Austria
*Austrian Association for Industrial Medicine, Schwarzspanierstrasse 17, A1090 Vienna.

Belgium
Centre Scientifique et Technique de la Construction, rue du Lombard 41, B-1000 Brussels.

Brazil
*Associação Brasileira de Prevençâo à Poluição do Ar, Departamento de Saúde Ambiental, Faculdade de Saúde Publica, Caixa Postal 8099, Sáo Paulo, Brazil.

Canada
Department of the Environment, Environmental Protection Service, Air Pollution Control Directorate, Ottawa, Ontario, K1A 0H3, Canada.

Czechoslovakia
1. Technical University of Prague, Faculty of Mechanical Engineering, Environmental Engineering Department Suchbátarova 4, Praha 6.
2. Czechoslovak Academy of Sciences, Institute for Physics of the Atmosphere, Boční 11, Praha 4.
3. Institute of Hygiene and Epidemiology, Institute of General and Communal Hygiene, Šrobárova 48, Praha 10.
4. Power Research Institute, Partyzánská 7a, Praha 7.
5. Research Institute of Air Engineering, Počernická 96, Praha 10.
6. Research Institute of Chemical Equipment, Počernicka 96, Praha 10.
7. Hydrometeorological Institute Department for Air Pollution Prevention, Na Šabatce 17, Praha 4–Komořany.
8. Slovak Hydrometeorological Institute, Jeseniova 43 Bratislava-Koliba.
9. State Technical Inspection for Air Pollution Centre, Italská 27, Praha 2.
10. Czechoslovak Research and Development Centre for Environmental Pollution Control–UNO/WHO Programme–Bratislava–Karlova Ves.

Denmark
Dansk Kedelforening and Danish Air Pollution Laboratory, Sankt Peders Vej 8, 2900 Hellerup.
National Health Service of Denmark, 1 St. Kongensgade, 1264 Copenhagen K.

Finland
Finnish Council for Air Conservation and Noise Abatement, Haartmaninkatu 1, 00290 Helsinki 29.
Ministry of Interior Affairs, Hallituskatu 4 E, 00170 Helsinki 17.

France
Association pour la Prévention de la Pollution Atmosphérique. M. Yvan QUERET, 62, rue de Courcelles, 75—PARIS 8°
Association Technique de l'Industrie du Gaz en France, 62, rue de Courcelles, 75—PARIS 8°
Centre d'Information pour le Dévelopement de Conditionnement d'Air, de la Ventilation, du Filtrage de l'Air et du Dépoussierage, 38, rue Copernic 75—PARIS 16°
Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique (C.I.T.E.P.A.), 28, rue de la Source, 75—PARIS XVIè.
Charbonnages de France, 9 avenue Percier, 75—PARIS 8°
Centre d'Etudes et de Recherches de Charbonnages de France (CERCHAR) 35, rue Saint-Dominique 75—PARIS 7°

Comité de coordination pour la Prévention de la Pollution Atmosphérique which comprises the three following: 21, rue Murillo 75 — PARIS 8° Président: M. le Professeur MOUREU:

1. Association pour la Prévention de la Pollution Atmosphérique (A.P.P.A.) 62 rue de Courcelles 75—PARIS 8°
2. Centre Interprofessional Technique d'Etudes de la Pollution Atmosphérique (C.I.T.E.P.A.). 28, rue de la Source 75—PARIS 16°
3. Comité National d'Action pour l'Assainissement de l'Atmosphère (C.A.P.A.), 54, avenue Marceau 75—PARIS 8°

Centre de Recherches pour la Pollution Atmosphérique (INSERM-C.R.P.A.) 3, rue Léon Bonnat 75—PARIS 16° 44, Chemin de Ronde 78—LE VESINET.
Centre National de la Recherche Scientifique (C.N.R.S.) 15, quai Anatole France 75—PARIS 7°
Délégation Générale à la Recherche Scientifique et Technique 103, rue de l'Université 75—PARIS 7°
Electricité de France, 75—PARIS 8°
Institut Français des Combustibles et de l'Energie, 3 rue Henri Heine, 75—PARIS 16°
Institut Français du Pétrole (I.F.P.) 1 et 4 avenue Bois Préau 92—RUEIL MALMAISON.
Institut National de Recherche Chimique Appliquée, 12, Quai Henry IV 75—PARIS 4°
Laboratoire Central de la Préfecture de Police, 39, bis rue de Dantzig 75—PARIS 15°. ajouter: "M. le Professeur CHOVIN".
Laboratoire "Prévention de la Pollution Atmosphérique" d'Electricité de France, 1, quai de Saint Ouen 93—SAINT DENIS.
Professeur ROUSSEL, 11 bis rue de Milan, 75—PARIS 9°
Société Française des Pétroles BP, 21 rue de la Bienfaisance, 75—PARIS 8°
Union Européenne de Médecine Sociale, 21 rue Murillo 75—PARIS 8°

Germany

*Abgasprüfstelle der DDR, Rudower Chaussee 6, 1199 Berlin-Adlershof.
Agrikulturchemisches Institut, Am Vogelsang 14, 5628 Heiligenhaus Bez. Düsseldorf.
Bundesgesundheitsamt, Institut für Wasser-, Boden- und Lufthygiene, Corrensplatz 1, 1000 Berlin 33.
Bundesministerium des Innern, Rheindorfer Str. 198, 5300 Bonn.
Deutsche Gesellschaft für Mineralölwissenschaft und Kohlechemie e.V., Mittelweg 180, 2000 Hamburg 13.
Deutscher Städtetag, Lindenallee 11, 5000 Köln-Marienburg.
Deutscher Verein von Gas- und Wasserfachmännern, Beethovenstr. 17, 6000 Frankfurt (Main).
Gaswärme-Institut Essen e.V., Holbeckshof, 4300 Essen-Steele.
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Council for Air Pollution, Ministry of Health and Environment, Dokter Reyersstraat 10, Leidschendam.
Division for Air Pollution, Gemeentelijk Bouw- en Woningtoezicht, Mauritskade 9-11, The Hague.
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Bituminous Coal Research Inc., 35 Hochberg Road, Monroe, Pittsburgh 13, PA.
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Other U.S. Governmental Air Pollution Agencies and individual State Agencies are listed in an annual Directory published by the Air Pollution Control Association in co-operation with the U.S. Dept. of Health, Education and Welfare. A copy of this Directory is available at the library of the National Society for Clean Air.

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Division of Environmental Health, World Health Organisation, Avenue Appia, 1211 Geneva 27, Switzerland.

The United Nations Economic Commission for Europe
Division of Environment and Housing, Palais des Nations, Geneva, Switzerland.

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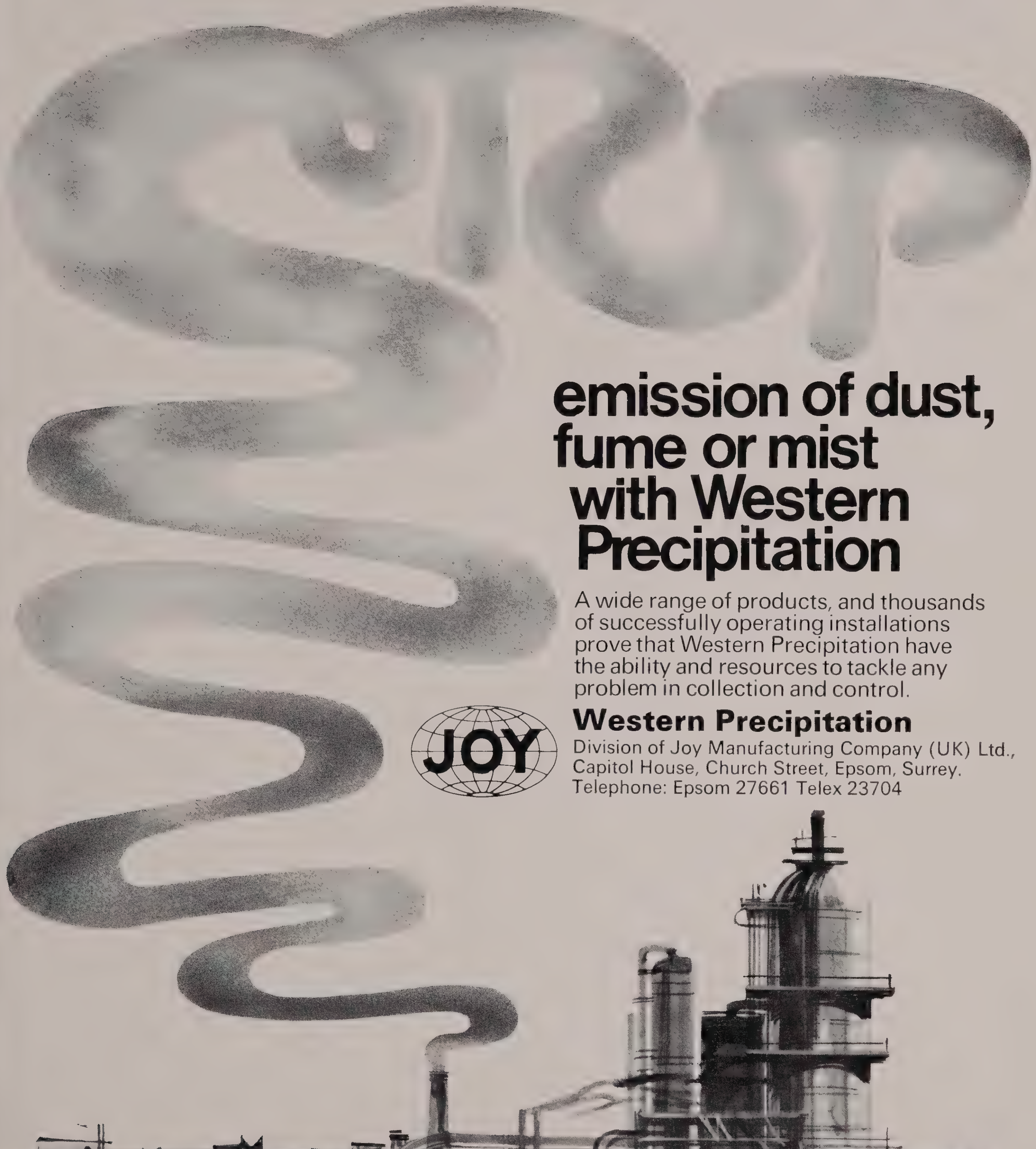

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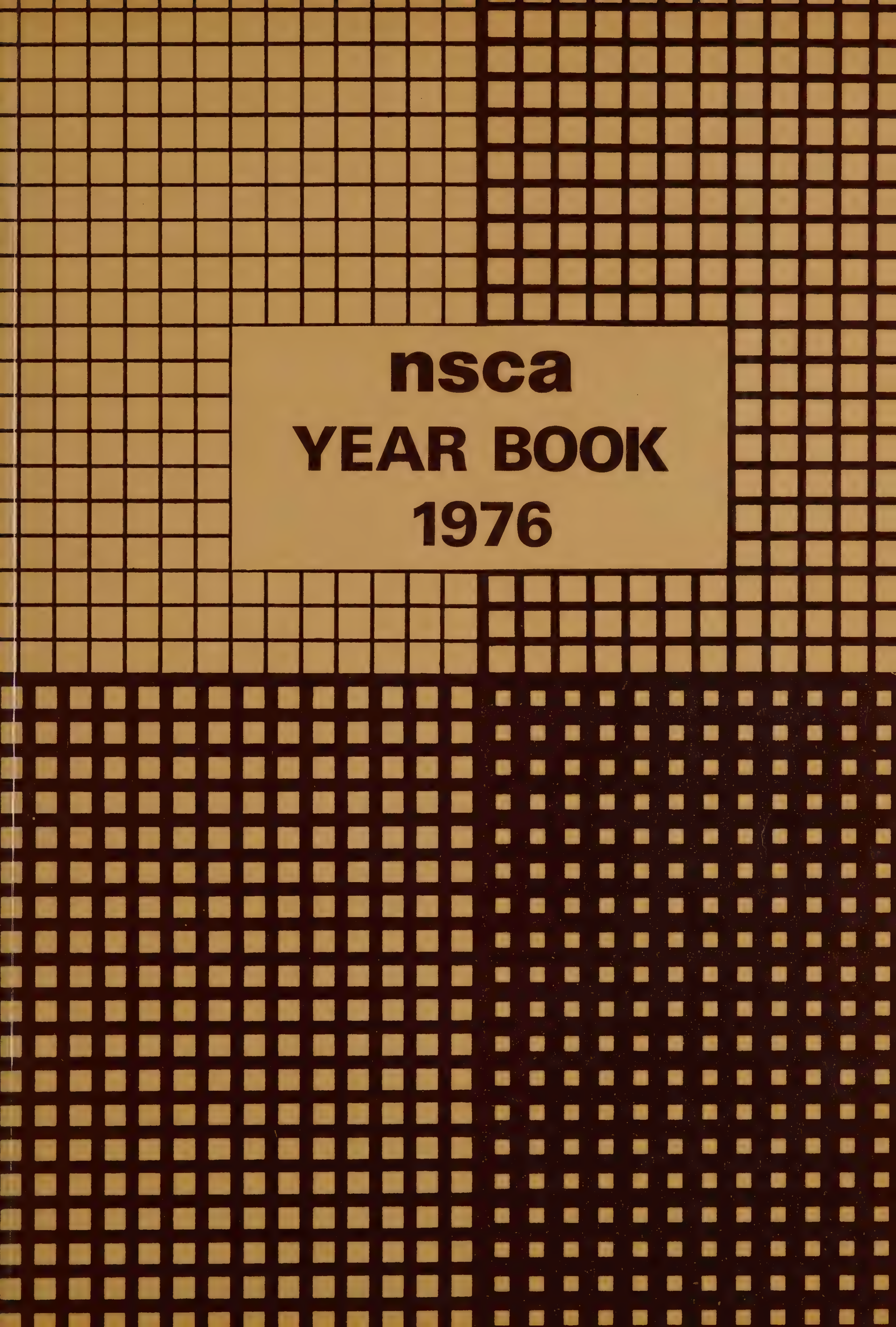

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YEAR BOOK
1976

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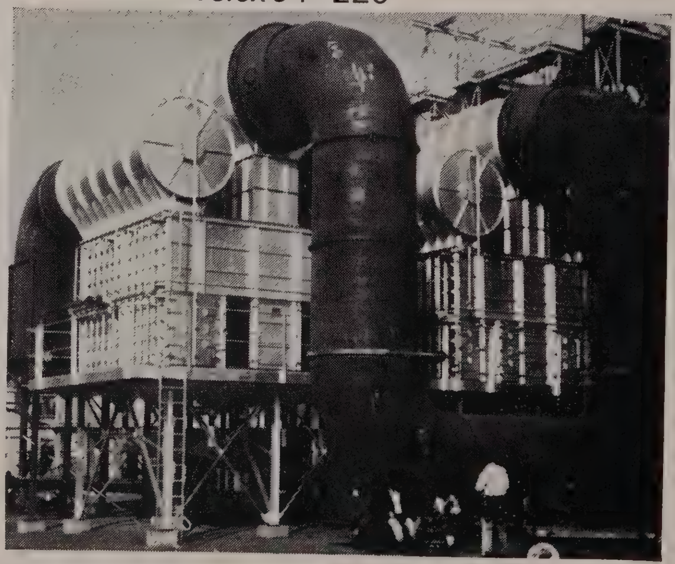

NATIONAL SOCIETY FOR CLEAN AIR
YEAR BOOK

Contents

Clean Air Progress—A Review 3

Section 1—The Society 5
Information about the Society 6
NSCA Officers, Council and Staff 7
Divisional Reports and Lists of Members 8
NSCA Annual Report and Accounts 16

Section 2—Air Pollution 23
Glossary of Terms Relating to Air Pollution 24
An Outline of the Law Relating to Air Pollution 36
Ringelmann Chart 58
Smoke Control Areas 60
The History of Air Pollution and its Control in Great Britain 65
Major Smog Disasters 66
The Clean Air Case 67
The Cost of Air Pollution 68
Estimates of Air Pollution 69
Comparison of Statistics 71
Garden Bonfires 73
The Use of SI Units in Environmental Technology 74
British Standards 77

Section 3—Noise 81
Noise and the Law 82
Noise and Noise Measurement 83
British Standards 85

Section 4—Water 87
Water Pollution Control in Great Britain 88
Treatment of Industrial Effluents 90
British Standards 92

Section 5—Pollution of the Land 93
The Throw-Away Age 94
Economics of Wastes and Hazardous Content 95
British Standards 97

Section 6—Conservation 99
Reorganisation for Recovery 100
Environment and Reorganisation 101

Section 7—Current Research Programmes 103
Current Research 104
Progress in Research on Air Pollution 111
Warren Spring Laboratory 124
University of Leeds 125
The Medical Research Council's Air Pollution Unit 126
Atomic Energy Research Establishment 128
Central Electricity Generating Board 131

Section 8—Guide to Publications 133
Films and Filmstrips 134
Recent Acquisitions to the NSCA Library 143
Guide to Publications 145

Section 9—Directories 151
Directory of Consultants 152
Directory of Organizations 155
The International Union of Air Pollution Prevention Associations 160
The Environmental Protection Equipment Manufacturers' Association 161
Industrial Gas Cleaning Association 161
Trade Directory and Buyers' Guide 168

Index to Advertisers

Newton Chambers Engineering Ltd Cover ii
Collectron (Dust Control) Ltd 20
Nailsea Engineering Ltd Cover iii
Sterling Industrial Cover iv

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Clean Air Progress

A Review

In the last issue of the Year Book we were able to say that the changes which had occurred, and the legislation enacted, during the previous twelve months should have a beneficial and lasting effect on the environment. This still holds true; but as a result of what has happened—or perhaps rather because of what has not happened—during the last year, the beneficial effects are still a long way off. For although the Control of Pollution Act received the Royal Assent in July, 1974, the provisions of the Act have not yet been implemented. The reason for this is, of course, the present economic climate and the consequent lack of money for such measures. So, as 1975 drew to a close, we were left still wondering when the provisions of the Control of Pollution Act, the first statute to deal solely and specifically with pollution in all its forms, would be implemented. There are signs, however, that those parts of the Act dealing with solid wastes, noise and air pollution will be brought into force during 1976, and we can only continue to hope that this will be so. But the implementation of the measures about water seem to be much further off, something which is to be deplored.

Unfortunately, the effects of the current economic climate do not end there. Although it was forecast that the rate of progress in smoke control would decrease, it was not expected that it would have been set back as much as it has. For set back it has been; many authorities have found it necessary to slow down their programmes and extend their completion dates, while others have regrettably stopped their programmes altogether. That some of the latter authorities should have been on the point of completion of their programmes is all the more regrettable. Once a programme has been stopped, it is much more difficult to restart it. Surveys made become out of date and have to be done again, and so money is wasted in this way. The cessation of a steady programme can, in the long run, be a false economy.

There is little doubt that this recession in smoke control has been influenced by Government Circulars. That on Rate Fund Expenditure issued in December 1974 stated "The Government accept that for the year ahead local authorities may not be able to undertake any more development in the field of smoke control". This form of wording, we are assured, was not intended to preclude any authorities from submitting smoke control orders which would be assessed on their merits. But although attempts were made to inform local authorities accordingly, it is only too clear that some of them have interpreted this clause as a mandate to slow down or stop their programmes.

While some authorities were wavering, the Circular on Local Authority Expenditure in 1976/77—Forward Planning, was issued in September 1975. This Circular says that "Anti pollution (e.g. clean air) measures may need to be curtailed". Again it can be argued that the wording is by no means mandatory; but again, some authorities have considered this to be a mandate to stop their programmes.

These Circulars have been issued at a time when, again for obvious economic reasons, people are being asked to save fuel in the national interest. Smoke control, by the use of proper smokeless heating appliances can help to save fuel. At a time when people are being exhorted to insulate their houses, and for which in some instances improvement grants are payable. it seems a false economy to delay the progress of smoke control—especially when surveys show, as they do in many areas, that as many as 50% of properties have already been converted and there will be no grants payable.

It is now nearly twenty years since the Clean Air Act was passed, and the Beaver Committee which laid the foundations for that legislation confidently expected that the whole country would be subject to smoke control long before this. Not only have the hopes of the Committee not been realised, but completion dates are extending further and further into the future. Smoke control does cost something; but the cost is not immense, and smoke control has long been recognised as the cheapest and most effective single action taken to clean the air.

All advocates of clean air are concerned about the present state of affairs—it is not just the members of the National Society for Clean Air. In October 1975 the Clean Air Council made strong representations to the Government, and it is to be hoped that this will have some effect.

This makes gloomy reading, but the facts cannot be blinked. 1975 has not been a good year for clean air and the environment. It is up to us to see that 1976 is a better one.

Other changes likely to affect the environment are consequent upon Britain's confirmed membership of the European Community.

During the campaign before the Referendum in June 1975, much was said on both sides about the advantages and disadvantages, the dangers and the benefits of continuing as a member of the EEC. But in the often emotive debate which went on, little or nothing was said about the environment, about clean air and the control of pollution. What was said was that if we remained a member of the Community, we would obviously have to subscribe to its rules and abide by them, even though we would have a very definite say in what the rules should be and how they should be observed. Air, whether it be clean or polluted, knows no boundaries, and so the "rules" regarding the control of pollution are of particular interest.

At present the nine member states each have their own legislation—the legislation which they consider suits them best. In the field of air pollution there are two classic approaches to its control; "the best practicable means" and "the air quality management" approach. We in this country are the exponents of the former; our neighbours in Europe mostly embrace the latter philosophy, and it is becoming clear that there are differences of opinion about how the whole problem of the control of pollution should be approached. Brussels and Luxembourg have not been idle and Directives and draft Directives on this subject are continually being produced. That the Community should work as a whole using the same standards may be rather idealistic; that it should work in harmony is essential. There will have to be give and take on all sides. Although BPM has served us well in the past, there are some in this country who do not like it, and it is significant that the Greater London Council have recently agreed guidelines for air quality for the principal pollutants. On the other side of the coin, there are many supporters of BPM on the Continent and they would like to see this philosophy applied in place of rather rigid standards often difficult to attain and maintain.

The essential point is that in the debate which is just starting, and which seems likely to continue for some time to come, the aim should be kept clearly in sight—cleaner air and a better environment for all. Whether this is achieved by air quality standards or BPM is of secondary importance; but we suspect that a combination of both—and much good will—will be needed.

SECTION 1

THE SOCIETY

Page

Information about the Society 6

NSCA Officers, Council and Staff 7

Divisional Reports and Lists of Members 8

NSCA Annual Report and Accounts 16

THE NATIONAL SOCIETY FOR CLEAN AIR

The parents of the Society were the Coal Smoke Abatement Society, established in London in 1899. In 1905 this Society combined with the Smoke Abatement League, a group of Provincial associations and became the National Smoke Abatement Society. The Society has since widened its horizon to cover all forms of air pollution and in 1958 the name was changed to the present one. The Society's membership includes private individuals both at home and abroad, local authorities, corporate bodies representing the learned societies and institutions, the fuel industries and industries concerned with the production of appliances and equipment for the control of air pollution.

The Society's object is to promote public education in all matters relating to the value and importance of clean air; and to initiate, promote and encourage investigation and research into all forms of pollution in order to achieve its reduction or prevention.

The Society publishes the proceedings of its annual conference in full. Other main publications are are journal *Clean Air* and the *NSCA Year Book*. Pamphlets, leaflets and booklets on particular subjects are also published from time to time.

The Society's main activities are the holding of conferences, meetings, exhibitions, arranging lectures and providing educational and publicity material; collecting and disseminating information in the form of books, periodicals, photographs and slides about the causes, effects and prevention of atmospheric pollution and other forms of pollution as they affect or are affected by atmospheric pollution.

General advice, assistance and information on such matters are available free of charge to members. The Society's Library is available for the use of all members, both for consultation in the Society's offices or for loan purposes. Students or research workers may also use the facilities provided. The Library possesses an extensive collection of British and foreign books, reports and papers on air pollution and related subjects. The Society also has a classified collection of photographs (mainly black and white) depicting domestic and industrial smoke, damage to buildings, stonework and plants and other allied subjects. A small collection of slides and filmstrips is also available for loan.

The Society is pleased to help members and others in any part of the country to arrange lectures and talks and is prepared to consider participating in suitable exhibitions. A mobile modular exhibition stand is available for this purpose. The Society advises members on display material and its arrangement for exhibitions. It supplies information for public meetings, local press features and correspondence. Special pamplets and information are available to schools, school children and students.

SUBSCRIPTIONS

(*The following is an extract from the Bye-laws of the Society*).

Annual Subscriptions shall be as hereinafter provided. A first annual subscription shall be made on application for Membership and shall continue in force until the first day of April of the following year, when it shall be renewable.

(a) Individual Members
The annual subscription payable by an Individual Member shall be not less than Three Pounds. On attainment of the age of 65 on payment of a sum of Ten Pounds, Individual Members may, at the discretion of the Council retain their membership of the Society in perpetuity, but always subject to the Council's rights of removal.

(b) Student Members
The annual subscription payable by non-graduate students pursuing their studies at school, college or university shall be One Pound.

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For each additional 500,000 or part thereof £10.00

(d) Corporate Members and Unincorporated Bodies appointed in accordance with Article 4(e) (ii)
The annual subscription payable by Corporate Members and Unincorporated Bodies shall be not less than as follows:
  (i) Small local civic societies, colleges, schools and similar organisations £5.00.
  (ii) Regional and national societies and similar organisations, consultants and small industrial and commercial firms £30.00.
  (iii) Industrial organisations £50.00.

(e) Sustaining Members
The annual subscription for Sustaining Members shall be not less than £100.00.

(f) Membership—Special Cases
The Council shall have power to elect any applicant for Membership to an appropriate grade of Membership, on such special terms as to subscription or otherwise as after considering any reasons for so doing stated by such applicant the Council may think proper.

NATIONAL SOCIETY FOR CLEAN AIR

136 North Street, Brighton BN1 1RG

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Northern Ireland: J. R. Lamont.

Northern: L. Mair, Cllr. L. Poole, Cllr. R. J. K. Shepherd.

North West: T. Baxter, H. Clusky, C. Darley, L. Goodman, W. E. Pollitt, J. Teal.

Yorkshire: L. Eastwood, Cllr. J. Mernagh, A. W. Perry, W. B. Twyford.

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South and Mid Wales: W. Bate, C. Summers, J. H. Warren.

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Asbestos Information Committee: A. A. Cross.
British Gas Corporation: E. A. K. Patrick.
British Steel Corporation: C. M. Davis.
Central Electricity Generating Board: A. J. Clarke.
Electrical Association for Women: Miss M. George.
Electricity Council: C. J. George.
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Environmental Health Officers' Association: T. H. Iddison.
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Institution of Gas Engineers: Dr. F. A. Burden.
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National Coal Board: R. W. C. Wheatley.
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Women's Solid Fuel Council: Mrs. J. Saunders.
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DIVISIONAL REPORTS
and
Membership as at 1st December 1975

Division 1
SCOTTISH DIVISION

President: I. B. Anderson
Hon. Secretary: F. J. Feeley

The year past has been almost uneventful from the Division's point of view. This has been caused by the Re-organisation of Local Government in Scotland which took place this year with which so many members of the Division were deeply involved.

This re-organisation has meant an approach to every new authority in Scotland to take membership of the Society. To date the response has not been encouraging but it is expected that membership will improve once the authorities have had an opportunity to find their feet. There has been some success as regards membership in that two of the new Health Boards have joined the Society, and it is hoped that the other Boards might follow the example which has been set.

The Division met on two occasions and the Executive Committee on three occasions during the year. At the Annual General Meeting, Mr. Ian B. Anderson, who has been appointed Director of Environmental Health with Inverclyde District Council, was re-elected President of the Division for a further year.

This year, the Division departed from the normal practice of holding a two-day conference and decided instead to limit it to one-day. This decision was taken as a result of the involvement of members in re-organisation. The guest speakers at the conference were Mr. A. E. R. Taylor, Chairman of the Clean Air Council for Scotland, and Rear-Admiral P. G. Sharp, and the delegates found the papers very interesting.

Towards the end of last year, the death occurred of Dr. W. A. Horne, former President of the Division. The passing of Dr. Horne has been a great loss to the Division.

F. J. Feeley
Hon. Secretary

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- South of Scotland Electricity Board
- The Scottish Gas Board

Local Authority Members
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- Glasgow, City of
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- Dunlop, W. A.
- Forbes, R. A.
- Foreman, J.
- Gibb, Dr. W.
- Hally, J.
- Jackson, J.
- MacPherson, I.
- McGhie, J. R.
- Ramsey, Captain E. C.
- Slimming, D. W.
- Vincent, Dr. J. H.

Division 2
NORTHERN IRELAND DIVISION

Chairman: R. Campbell Brown
Hon. Secretary: J. R. Lamont

During the year there were two meetings of the Divisional Council and one meeting of the Division. The proposed one-day conference to be held in November has been rearranged for 1976.

The main event of the year was the Annual General Meeting held on Monday, 28th April. In his annual review of the year the Chairman of the Division, Mr. R. Campbell Brown, recalled the activities of the Society and paid tribute to members of the Divisional Council who were actively promoting the aims of the Society despite the continued unrest in the Province. Mr. Brown also congratulated the local authorities and their officers who were pressing on with Smoke Control programmes in difficult conditions.

Following the business of the meeting the film "Sources and Effects" was shown. This film was produced by the Leverhulme Project at Loughborough University of Technology.

While 15 of the 26 District Councils have taken up membership of the Society and one or two more are still considering the matter, the Division is still anxious to encourage further involvement of the Authorities. We are now looking towards other bodies in industry and education for others who share our concern about Clean Air and who might join the Society.

J. R. Lamont
Hon. Secretary

MEMBERSHIP LIST

Local Authority Members

Antrim District Council
Armagh District Council
Ards Borough Council
Ballymena Borough Council
Belfast City Council
Carrickfurgus District Council
Castlereagh District Council
Coleraine District Council
Cookstown District Council
Craigavon District Council
Larne District Council
Lisburn Borough Council
Londonderry City Council
Newry & Mourne District Council
Newtownabbey District Council

Corporate Members

Eastern Health & Social Services Board

Individual Members

Cave, S. A.
Ellison, C. A.
Hanna, B. P.
Lynas, K. H.
Millar, J.

Division 3

NORTHERN DIVISION

Chairman: Cllr. L. Poole
Hon. Secretary: L. Mair

Because of Local Government Re-organisation and the reconstruction of the Society itself the past year has been extremely difficult. Much too much time and effort had to be diverted to administrative and organisational problems and much too little to air pollution abatement. Many of the problems arose from the difficulty of creating and maintaining a Members' Register for this Division because of the upheaval created by Local Government Re-organisation and indeed it was not until the end of 1974 that plans could be made for the inaugural general meeting of the Division. This was held on the 14th February, 1975 and was held in the Civic Centre, Newcastle upon Tyne, at which date, of the 29 local authorities comprised in the new geographical Division, only 18 were members of the Society at the time of the meeting. Some 50 members attended and a very notable and welcome feature on this occasion was the presence of the Secretary General, Rear Admiral Sharp, who delivered a general talk to the delegates outlining and explaining the new organisational structure of the Society and the need for continuing and expanding membership.

At this meeting the Chairman, Mr. B. N. Young, O.B.E., was making his last appearance in that capacity after being a representative of the Division for almost thirty years. The election of officers resulted in Councillor L. Poole being elected as Chairman, Professor P. C. G. Isaac of the University of Newcastle upon Tyne and Councillor T. W. Yellowley of Newcastle upon Tyne being elected as Vice-Chairmen; Mr. L. Mair was re-elected as Honorary Secretary and Mr. A. S. A. Archer, City Treasurer, Newcastle upon Tyne, as Honorary Auditor. The divisional representatives elected comprised Councillor L. Poole, Chairman; Mr. L. Mair, Honorary Secretary and Councillor R. J. K. Shepherd of Carlisle.

Although at the end of 1973 smoke control activity in in the Division had accelerated largely as a result of the Clean Air Council Investigation Panel of 1972, during the later months of the period under review it was obvious that the economic climate was having an inhibiting effect on further progress. In particular the construction of Para. 39 of Circular 171/74 of the Department of the Environment appeared to contain disastrous implications from an air pollution point of view and many members of the Northern Division felt that the circumstances existing in the North East justified this Division being regarded as a special case and should be exempt from the restrictions imposed by circular 171/74. Representations to this effect were sent to the Clean Air Council with copies to the Secretary of State for the Department of the Environment. Nevertheless, the overriding need for extreme economy in local government expenditure is bound to have an adverse effect upon progress within the next year or so.

It is hoped that the next annual report of the Northern Division will contain more encouraging portents for the future.

L. Mair
Hon. Secretary

MEMBERSHIP LIST

Sustaining Members

National Coal Board
Northern Gas

Local Authority Members

Allerdale District Council
Barrow in Furness District Council
Blythe Valley Borough Council
Carlisle District Council
Castle Morpeth District Council
Chester-le-Street District Council
Durham City Council
Easington District Council
Gateshead Metropolitan District Council
Hartlepool District Council
Langbaurgh Borough Council
Middlesbrough Borough Council
Newcastle Upon Tyne Metropolitan Borough Council
North Tyneside Borough Council
Sedgefield District Council
South Tyneside Borough Council
Stockton On Tees District Council
Sunderland Borough Council
Wansbeck District Council
Wear Valley District Council

Corporate Members

Central Electricity Generating Board North Eastern Region
Coal Merchants Federation of Great Britain, Northern Region
North Eastern Electricity Board
Procter & Gamble Ltd.

Individual Members

Calvert, Mrs. M. R.
Carr, W.
Cayton, S.
Chambers, A.
Cosgrove, J.
Dagleish, J.
Eve, Mrs. M. E.
Isaac, Prof. P. C. G.
Reece, R.
Spriggs, Dr. E. A.
Walker, A. S.
Wilkinson, J. R.
Young, B. N.

Division 4

NORTH WEST DIVISION

Chairman: C. Darley
Hon. Secretary: W. E. Pollitt

The Annual General Meeting of the North West Division was held in September, 1974, at the Headquarters of M.A.N.W.E.B., Sealand, Chester. Members of the North West Division were entertained to lunch by the Merseyside and North Wales Electricity Board and had the pleasure of listening to Mr. R. C. Hodson of N.O.R.W.E.B., whose subject was "An Electrical

Contribution to Clean Air Environment", and Mr. E. Redman of M.A.N.W.E.B., who spoke on "Electricity in the Treatment of Effluent". All who attended were greatly impressed by the manner in which both these gentlemen presented their papers and in the efficient way they answered members' questions.

Due to a change in the date of the Annual General Meeting at the request of the National Executive the 1974/75 period is only from September to June. Due to Local Government re-organisation, only two meetings of the Divisional Council have been held. Both these meetings have been concerned with the new Constitution of the North West Division, which it is hoped will receive your approval today.

As far as membership is concerned we have at the moment 28 Local Authority members, 54 Private members and 22 Corporate or Sustaining members.

There are still many Local Authorities in the North West Division who have not yet joined the Society. It is intended that a fresh approach will now be made in the hope that these Local Authorities have now settled down after the re-organisation period and will take up membership.

During the period under review speakers have again been provided to Schools, Ladies Guilds, Student Groups, Rotary Clubs, etc.

It is regretted that due to the present financial situation many Local Authorities may stop their Domestic Smoke Control Programmes. The Society urges all Local Authorities to continue with their programmes for there is no doubt the longer the problem is left the more it will cost. It is a once and for all payment, the benefits of which are shared by everybody. Do it now!

W. E. Pollitt
Hon. Secretary

MEMBERSHIP LIST

Sustaining Members

Cheshire County Council
Manchester City Council
Mather & Platt Ltd.
National Coal Board
North Western Electricity Board
North West Gas
Shell Chemicals U.K. Ltd.

Local Authority Members

Alyn & Deeside District Council
Blackpool Borough Council
Bolton Borough Council
Burnley Borough Council
Bury Metropolitan Borough Council
Delyn District Council
Fylde Borough Council
Greater Manchester County Council
Halton District Council
Hyndburn District Council
Knowsley Metropolitan Borough
Liverpool City Council
Macclesfield District Council
Oldham Metropolitan Borough Council
Pendle District Council
Preston Borough Council
South Ribble Borough Council
Rochdale Metropolitan Borough Council
Rossendale Borough Council
Salford Metropolitan District Council
Sefton Metropolitan District Council
St. Helens Borough Council
Stockport Metropolitan Borough Council
Tameside Metropolitan District Council
Trafford Metropolitan District Council
Warrington Borough Council
West Lancashire District Council
Wigan Metropolitan Borough Council
Wirrall Metropolitan Borough Council

Corporate Members

Central Electricity Generating Board, N. West Region
Greater Manchester Council for Clean Air & Noise Control
Macclesfield Civic Society
Merseyside & North Wales Electricity Board
Nailsea Engineering Ltd.
N.W. Regional C'tee., Coal Merchants Fed., G.B.
Robinson Willey Ltd.
Sutcliffe Speakman & Co. Ltd.
The Woolton Society

Individual Members

Ault, H.
Barnes, W.
Baxter, T.
Behrens, A.
Brown, P. S.
Cass, H. V., M.B.E.
Chandler, Professor T. J.
Christian, F. V.
Clusky, H.
Cooper, R. I.
Evans, T.
Fallows, W. B
Franklin, E. J.
Franklin, N. J.
Gee, Mrs. Joyce
Gee, J.
Gibbons, E. B.
Hall, A.
Halliday, A. C.
Hallows, V. K.
Hayhurst, H.
Hayhurst, Mrs. K. M.
Heald, Dr. G. E.
Hendy, Dr. B.
Hough, D. A.
Jackson, C. L.
Jewsbury, S.
Kitchener, Earl
Leech, Dr. P. W.
Lloyd, A.
Lowe, T. H.
Malcolm, C. V.
Mather, Sir William
Pike, Miss I. M.
Pollitt, W. E.
Potter, Dr. H. M.
Richards, J. E.
Roots, D. C.
Shaw, Mrs. M.
Stanyard, R. J.
Taylor, A.
Taylor, S.
Thomas, F. L.
Vanstone, H. B.
Winder, F.

Division 5
YORKSHIRE DIVISION

Chairman: L. Eastwood
Hon. Secretary: W. B. Twyford

In common with most other Societies associated with Local Government, the Yorkshire Division has been going through a post Re-organisation phase and in the case of the Division, this has been aggravated by the severence of long-standing secretarial ties with the Officers of the former Leeds City Council but notwithstanding this, some progress has been made, which will, I think, lay a useful foundation for the future.

At its first meeting, the newly-elected Divisional Council undertook a complete re-appraisal of the Division's activities and this resulted in a reduction in the size of the Divisional Council which was brought about by reducing the number of Co-opted Members and the decision to involve the general Membership far more in the activities of the Division.

The number of Co-opted Members was reduced to six, one from each of the major fuel industries, plus a representative from the British Steel Corporation and the Alkali Inspectorate. Each of these Co-opted Members is to represent all activities coming within their respective fields.

There have been four meetings of the Yorkshire Divisional Council and three Open Meetings, including the A.G.M. at Leeds.

In addition, there has been a Joint Meeting of the Divisional Council and the Executive Committee of the Yorkshire and Humberside Advisory Council for Clean Air and Noise Control which was held at Rotherham on the 3rd April, 1975.

As was indicated in the opening paragraph of this report, the year has been formative in character. Attendances at meetings have been disappointing but the papers presented and the quality of discussion have been exceedingly high and give cause for optimism in viewing the future activities of the Division.

In my introductory paragraph, I commented on the severance of long-standing secretarial ties with the Officers of the former Leeds City Council and it would be improper if I did not formally record the debt which I, and indeed the whole of the Yorkshire Division, and the Society as a whole, owe to Mr. J. H. Wyatt, and his predecessor, Mr. J. G. Goodfellow, for the work they have done in the past to further the aims of the Society.

W. B. Twyford
Hon. Secretary

MEMBERSHIP LIST

Sustaining Members
National Coal Board
North East Gas
Yorkshire Electricity Board

Local Authority Members
Barnsley District Council
Booth Ferry District Council
Bradford Metropolitan District Council
Cleethorpes District Council
Doncaster Borough Council
Glanford District Council
Grimsby District Council
Harrogate District Council
Kingston upon Hull, City of
Kirklees Metropolitan Borough Council
Leeds City Council
North Yorkshire County Council
Rotherham Borough Council
Scarborough Borough Council
Selby District Council
Sheffield City Council
South Yorkshire County Council
Wakefield Metropolitan District Council
West Yorkshire County Council
York City Council

Corporate Members
British Acheson Electrodes Ltd.
British Steel Corporation
Central Electricity Generating Board, North Eastern Region
Yorkshire & Humberside Advisory Council For Clean Air & Noise Control

Individual Members
Bacalis, N.
Ball, J. D.
Bell. T. R. H.
Diprose, R. J.
Earnshaw, D. N.
Etherington, H.
Fleming, I.
Gittings, M. J.
Hackney, E. S.
Hutton, Dr. K.
Imire, B. W.
Jones, L.
Leadbeater, Dr. B.
McLaughlin, D. F.
Marshall, G. C.
Miller, Dr. J. E.
Perry, A. W.
Reynolds, F.
Saword, A. C.
Sewell, Dr. P.
Tomlinson, E. S.
Ulmanis, A.
Winfield, E. J.
Wraith, M. D.

Division 6
WEST MIDLANDS DIVISION

Chairman: H. E. T. Lowbridge
Hon. Secretary: D. A. Spurrier

Two meetings of the Divisional Council were held during the year at Birmingham Council House. The first held on Wednesday, March 26th, was addressed by Mr. D. T. Tomi, of Cremer and Warner and Partners, who spoke about his experience and role in the design and implementation of an integrated mobile laboratory for monitoring ambient air quality, developed by his company for the Philips Petroleum Company, Teeside. The second meeting was held on Wednesday, 7th May, to discuss in particular the future of the Division and how a greater degree of participation and interest could be generated.

Only in recent months have the membership and representation in the Division become clearer. Most district councils, particularly those in urban areas and metropolitan districts are now members, the greatest gap being county councils. None of the county councils in the West Midlands are members despite several approaches to the Chief Executives pointing out the wider interests of the Society in waste disposal and the planning field.

Mr. A. R. Williams, Honorary Treasurer, retired in June, when he retired from his position with L.C.P. Fuels Limited, Mechanised Handling Division, at Smallheath, Birmingham.

The Divisional A.G.M. was held at the N.C.C. (Rexco) Ltd., Snibston Plant, when Mr. H. E. T. Lowbridge, an individual member, was re-elected Chairman of the Divisional Council.

D. A. Spurrier
Hon. Secretary

MEMBERSHIP LIST

Sustaining Members
National Coal Board
Midlands Electricity Board
West Midlands Gas

Local Authority Members
City of Birmingham
Cannock Chase District Council
Coventry City Council
Dudley Metropolitan Borough Council
Hereford District Council
Newcastle-under-Lyne Borough Council
North Warwickshire District Council
Nuneaton District Council
Redditch Borough Council
Rugby District Council
Sandwell Metropolitan Borough Council
South Staffordshire District Council
Stafford Borough Council
Staffordshire County Council
Stoke-on-Trent District Council
Tamworth District Council
Walsall Metropolitan Borough Council
Warwick District Council
Wolverhampton Metropolitan Borough Council
Worcester City Council
Wrekin District Council
Wyre Forest District Council

Corporate Members
The University of Aston in Birmingham
Cradley Boiler Co. Ltd.
Guest Keen & Nettlefolds Ltd.
Lodge-Cottrell Ltd.

Individual Members
Busby, H. G. T.
Cockerham, Dr. R. G.
Cawley, Lady
Darnell, J. R.
Garner, W. A
Gillett, J. A.
Grimmett, P. H. G.
Hawksley, P. G. W.
Hockton, D.
Knightbridge, C. R.
Longley, J. C.
Lowbridge, H. E. T.
Owen, A. G.
Reynolds, K.
Roberts, R. E. J.
Taylor, C. B.

Division 7
EAST MIDLANDS DIVISION
Division 8
EASTERN DIVISION

Chairman: J. Jones
Hon Secretary: E. F. Raven

Secretarially speaking our meetings in East Midlands during 1975 began at home, as charity is reputed to do, when we met in Derby on 27th March, 1975. Dr. R. V. Riley, chaired the morning meeting in the Council Chamber where we were welcomed by the Mayor (Councillor G. F. Salt, J.P.). Rear Admiral Sharp, Secretary General of the Society, making his first visit to Derby gave an assessment of the position with regard to new legislation and the current trends in pollution control. The main item of the morning was a paper by Mr. H. M. Clayton, Manager, Manufacture and Maintenance at Rolls-Royce (1971) Limited who gave an absorbing paper on the development and manufacture of the RB 211 Aero engine. This paper appears in the Autumn Edition of 'Clean Air'. In the afternoon members visited the Rolls-Royce works where Admiral Sharp 'signed-in' for us and lingered for a few moments swapping nautical memories with the Commissionaire, part of whose regalia evidently conveyed that he was a former Chief Petty Officer. The account of our visit has also appeared in 'Clean Air', and members were grateful for the opportunity to see this famous establishment.

In June 1975 the scene moves to Corby, well known for the British Steel Corporation, for whom, Dr. Riley, our Chairman at that time, is Pollution Control Co-ordinator. The Corby District Council are also strong supporters of the Society, and so for this, our Annual General Meeting, we had available the Civic Centre by courtesy of the Council, whilst our Speaker for the morning, Mr. R. J. Cowan, A.R.I.C.S., and one of our visits for the afternoon, were provided by the British Steel Corporation. Corby is not all steel and another party visited the Golden Wonder Crisp Factory.

At the Annual General Meeting Mr. J. Jones, Chief Environmental Health Officer for Lincoln succeeded Dr. Riley as Chairman with Councillor W. R. Cashmore of Peterborough (at present Mayor of that City) became Vice Chairman. The Hon. Secretary was re-elected as were the Hon. Auditor (Mr. J. B. Sheard, Amber Valley) and the Scrutineers (Mr. V. Wales, Chief Smoke Inspector, Nottingham) and Mr. A. A. Wild (Chief Environmental Health Officer, Erewash).

Other elected members of the Divisional Council for 1975/76 are: Mr. J. B. Brackenbury (Chesterfield Borough Council), Councillor C. A. Butler (City of Nottingham), Councillor W. Dunn (South Derbyshire District Council), Mr. H. B. Dunstan (National Coal Board), Mr. J. F. Edwards (City of Cambridge), Mr. J. L. Fear (N.W. Leicestershire District Council), Councillor J. H. Gregory (Newark District Council), Councillor J. E. Hall (City of Peterborough), Councillor C. E. Holland (Ashfield District Council), Councillor C. Jaques (Huntingdon District Council), Mr. R. W. Lander (South Derbyshire District Council), Mr. J. E. Marsh (Mansfield District Council), Mr. A. L. Robinson (Individual Member), Mr. J. B. Sheard (Amber Valley District Council), Councillor Mrs. E. E. Stewart (Corby District Council), Councillor Mrs. E. M. Tomlinson (High Peak Borough Council), Mr. A. Wild (Erewash Borough Council), Councillor D. C. Wildey (Erewash Borough Council), and there are 7 co-opted members namely: Mr. F. N. Beveridge (NIFES), Dr. D. Davies (Consultant Chest Physician), Mr. R. J. Harrison (East Midlands Gas Board), Mr. R. Pane (Coalite), Dr. R. V. Riley (British Steel Corporation), Mr. A. Taylor (Amoco (UK) Ltd.), Mr. V. Wales (Nottingham City Council).

The proceedings of this meeting have appeared in 'Clean Air'.

September found us in Peterborough for the third time in four years where we not only had the warm welcome and generous hospitality so characteristic of Peterborough, but also yet another day of sunshine for the 70 people attending—something else that Peterborough seems to 'lay on'. Following a Civic Welcome by the Mayor (Councillor W. R. Cashmore) a challenging talk entitled, "Engineering Diesels for Legislation", was given by Mr. R. Bertodo, Director of Engineering, Perkins Engines Group Limited.

In the afternoon visits were made to the Perkins Engines Factory and also by courtesy of British Rail to a Powered Signal Box.

Attendance at Divisional Meetings has been very encouraging and this has been matched at Divisional Council Meetings. These have been held in Leicester, Cambridge and Grantham. An unusual matter under discussion has been the problem of the use of plastics in coffins and the resultant difficulties at the Crematoria. There is evidence that this is a matter of national concern.

Both the Division and one of its members have been honoured this year in having a Vice President created in the person of Mr. T. Henry Turner, M.Sc. Those who know Mr. Turner (and who does not?) will agree that this recognition is fully merited in the light of all that he has contributed—and despite his 80 years continues to contribute—to the cause of clean air.

On 1st November 1975 Leicester became the first city in the East Midlands to complete its smoke control programme and at the time of going to press arrangements are being made to mark the occasion by a first meeting of the East Midlands Division and the East Midlands Centre of the Environmental Health Officers Association at which Professor P. J. Lawther, President of the NSCA, is due to speak.

I feel some degree of responsibility towards the Eastern Division which so far has not started a separate existence, but in the near future I hope at least to begin keeping them informed of what is happening even though it may be impossible to meet in their area or for them to come to East Midlands.

My report ends, as I have no doubt others will, on a reflective note. We have the Health and Safety at Work Act 1974 and the Control of Pollution Act 1974. It is disappointing that this legislation virtually coincided with the massive increase in oil prices and the ensuing inflation and other economic difficulties. Environmental matters tend to be amongst the first to come under pressure in times of financial difficulty and it is essential that not merely as a Society, but also as Divisions we keep alive the awareness of pollution problems and ensure that even though there may be a period of 'holding the fort', we do not lose the initiative entirely.

E. F. Raven
Hon. Secretary

MEMBERSHIP LIST

East Midlands

Sustaining Members

Coalite and Chemical Products Ltd.
East Midlands Electricity Board
East Midlands Gas
National Coal Board
Rolls-Royce (1971) Ltd.

Local Authority Members

Amber Valley District Council
Ashfield District Council
Bassetlaw District Council
Blaby District Council
Bolsover District Council
Boston District Council
Cambridge City Council
Charnwood District Council
Chesterfield Borough Council
Daventry District Council
Derby Borough Council
Erewash District Council
Fenland District Council
Gedling District Council
Harborough District Council
High Peak District Council
Hinckley & Bosworth District Council
Huntingdon District Council
Leicester City Council
Lincoln City Council
Mansfield District Council
Newark District Council
North East Derbyshire District Council
North Kesteven District Council
North West Leicestershire District Council
Nottingham City Council
Peterborough City Council
Rushcliffe Borough Council
South Derbyshire District Council
South Holland District Council
Wellingborough District Council
West Derbyshire District Council

Corporate Members

British Steel Corporation, Chemicals Division
British Steel Corporation, Tubes Division
Central Electricity Generating Board, Midlands Region
Dust Control Equipment Ltd.
Low Temperature Coal Distillers Association of Great Britain Ltd.
National Carbonising Co. Ltd.

Individual Members

Allison, G.
Brown, J. A.
Catlow, J.
Crowther, J. S.
Davies, D.
Drabble, G.
Fisher, G. R.
Harris, T. A.
Hunt, Dr. J. C.
Jones, B. T.
McDonald, J.
Pepperdine, E. C.
Robinson, A. Lister
Store, N. J.
Scopes, F. V.
Turner, Miss H. E.
Turner, T. Henry
Vulliamy, N. M. E.
Wade, A.
Waring, F. L., C.B.E.
Weldon, Miss G. M.

Eastern

Sustaining Members

Eastern Electricity Board

Local Authority Members

Basildon District Council
Braintree District Council
Brentwood District Council
Castle Point District Council
Colchester Borough Council
Epping Forest District Council
Harlow District Council
Ipswich Borough Council
Mid Suffolk District Council
Norwich City Council
Rochford District Council
Southend-on-Sea Borough Council
Thurrock Borough Council

Corporate Members

Ford Motor Company Ltd.

Individual Members

Clinch, H. G.
Dobson, P. F.
Fisher, A. H.
Goodfellow, J.
Parsons, E.
Stephenson, Dr. R. J.

Division 9
LONDON AND SOUTH EAST DIVISION

Division 10
CENTRAL SOUTHERN DIVISION

Chairman: T. H. Iddison
Hon. Secretary: B. C. Upton

A Divisional Council meeting was held in January 1975 at which the future of the London and South East Division and the Central Southern Division was considered. There was a discussion on the problems of running the Central Southern Division as a separate body after which it was resolved that the two Divisions should continue to operate as one.

The Annual General Meeting of the Division was held at the offices of the National Coal Board, Hobart House, Grosvenor Place, London, on 30 April 1975. After the business meeting a talk was given by Mr. J. S. Sawyer, F.R.S., Director of Research, Meteorological Office, Bracknell on "Some interactions between air pollution and climate on a regional and world-wide scale". This was published in the Autumn issue of 'Clean Air'.

A programme of visits was organised for 1975, the first one being a visit to Vauxhall Motors at Luton in July. Members and representatives who attended thoroughly enjoyed the tour of the works which proved to be extremely interesting. Further visits were arranged in October to Southampton University for a talk on noise and in December to Imperial College, London, for a talk on methods of air pollution measurement. During a Divisional Council meeting held in September a presentation was made to Mr. W. Combey in recognition of his many years of service as Chairman of the Division.

B. C. Upton
Hon. Secretary

MEMBERSHIP LIST

London & South East

Sustaining Members

British Gas Corporation
British Petroleum Co. Ltd.
British Steel Corporation
Central Electricity Generating Board
Coal Merchants Federation of Great Britain
Courtaulds Ltd.
Eastern Gas Board
Electricity Council
Environmental Protection Equipment Manufacturers' Association
Esso Petroleum Company Ltd.
Greater London Council
Imperial Chemical Industries Ltd.
National Carbonising Co. Ltd.
National Coal Board
North Thames Gas Board
Shell International Petroleum Co. Ltd.
Shell-Mex and B.P. Ltd.
South Eastern Gas Board

Local Authority Members

Ashford Borough Council
Barnet, London Borough of
Bexley, London Borough of
Brent, London Borough of
Brighton Borough Council
Bromley, London Borough of
Camden, London Borough of
Crawley Borough Council
Dacorum District Council
Dartford District Council
Dover District Council
Ealing, London Borough of
Eastbourne Borough Council

Elmbridge District Council
Enfield, London Borough of
Epsom & Ewell Borough Council
Gillingham Borough Council
Gravesham Borough Council
Greenwich, London Borough of
Guildford Borough Council
Hackney, London Borough of
Hammersmith, London Borough of
Harrow, London Borough of
Havering, London Borough of
Hillingdon, London Borough of
Hounslow, London Borough of
Islington, London Borough of
Kensington & Chelsea, London Borough of
Kingston Upon Thames, London Borough of
Lambeth, London Borough of
Lewes District Council
Lewisham, London Borough of
London, City of
Medway Borough Council
Merton, London Borough of
Mid-Sussex Borough Council
Redbridge, London Borough of
Reigate & Banstead Borough Council
Richmond Upon Thames, London Borough of
Runnymede District Council
Shepway District Council
Southwark, London Borough of
Surrey Heath District Council
Sutton, London Borough of
Three Rivers District Council
Tower Hamlets, London Borough of
Wandsworth, London Borough of
Watford Borough Council
Waverley Borough Council
Welwyn Hatfield Borough Council
Westminster, City of
Woking Borough Council
Worthing Borough Council

Corporate Members
Asbestos Information Committee
British Independent Steel Producers' Association
Buckle, G. H. & Partners
Caltex (U.K.) Ltd.
Centri-Spray Ltd.
Charringtons Solid Fuel Ltd.
Chemical Construction (G.B.) Ltd.
Conoco Ltd.
Drummond Dust & Fume Extractors Ltd.
Dust Suppression Ltd.
Electrical Association for Women
Englehard Sales Ltd.
Environmental Health Officers Association
Flaregas Engineering Ltd.
Geldia (London) Ltd.
A. Guinness, Son and Co. (Park Royal) Ltd.
Harvey J. Smith & Associates
Howden Engineering Ltd.
Industrial Gas Cleaning Association
Institute of Fuel
Institution of Gas Engineers
Institute of Petroleum
John Zinc Co. Ltd.
London Electricity Board
London Transport
Metal Box Co. Ltd.
Mobil Oil Co. Ltd.
Public Road Transport Association
Radiation Ltd.
Road Haulage Association
Royal Society of Health
S.F. Air Treatment Ltd.
Solid Smokeless Fuels Federation
South Eastern Electricity Board
Sturtevant Engineering Ltd.
Sumner, G. & Partners
Women's Solid Fuel Council
Women's Gas Federation and Young Homemakers

Individual Members
Acworth, Miss E. A.
Ashby, R. F.
Barber, D.
Beaumont, M.
Birt, Sqn. Ldr. A. E .
Bond, Prof. G. G.
Bottom, D. W.
Boult, Sir Adrian C.
Bradshaw, N. F.
Brown, H.
Buist, Commander C.
Butler, J. W.
Carter, Dr J. S.
Chandler, T. J.
Chapman, W. B.
Chatfield, A. J.
Clancey, J.
Coker, W. G.
Colville, Lt. Com. R. F.
Comer, P. J.
Courtier, G. B.
Craxford, Dr. S. R.
Curtis, B.
East, R. G.
Eaton, Dr. F. J.
Ellis, P. T. A.
Elsworth, Mrs. F. S.
Fisher, Mrs. F.
Forrester, Dr. C.
Fowle, Lady Honour C.
Gandy, Miss R. L.
Garland, G. E.
Gillett, T.
Gimpel, Mrs. C.
Goldsmith, A.
Grant, P. M.
Greenhead, E.
Hamilton, Dr. P. M.
Haslam, W.
Held, P. E. J.
Henson, C. G.
Hickman, Miss V.
How, M. D.
Ingus, Miss A. M.
Jackman, F. A.
James, B. W.
Langwell, W. H.
Lord, D. G.
Marsden, R.
Menuhin, Yehudi
Miles, S. E.
Monkhouse, Dr. A. C.
Mowle, C. R.
Parker, Dr. A.
Parker, Dr. R. A.
Pennington, W J.
Poole, Mrs. W. M.
Rice, A. P.
Rosling, Miss E. M.
Scorer, Professor R. S.
Seale, R. J.
Shanks, E. C.
Shillito, D. E.
Silver, O. B.
Smith, Mrs. P.
Stoddard, Dr. A.
Stubbs, G. C.
Sutherland, Miss E. A.
Todd, G. F.
Toni, D. T.
Train, Dr. D.
Turner, Dr. W. C.
Vine, Mr. and Mrs. G. M.
Des Voex, Mrs. M. F.
Walker, D. M.
Watson, Professor H. E.
Wermann, J. C.
Westbrook, J.
Wigan, H. N.
Wooldridge, K. G. W.

Local Authority Members
Aylesbury Vale District Council
Bedfordshire County Council
Cherwell District Council
Chiltern District Council
Fareham District Council
Gosport Borough Council
Havant District Council
Mid Bedfordshire District Council
Milton Keynes Borough Council
New Forest District Council
Oxford, City of
Portsmouth, City of
Rushmoor Borough Council
Slough District Council
South Bedfordshire District Council
Southampton, City of
South Oxfordshire District Council
Vale of Whitehorse District Council
Winchester, City of
Windsor & Maidenhead, Royal Borough of
Wycombe Borough Council

Corporate Members
Atomic Energy Research Establishment
Southern Gas Board
Southern Electricity Board

Individual Members
Armstrong, F. W.
Bartlam, J. M.
Bastock, P. E.
Bradbury-Williams, J. C.
Bryant, Miss P. M.
Combey, W.
Cowling, D. W.
Haywood, L. H.
Hinde, Dr. P. T.
Nonhebel, Dr. G.
Parry, M.
Scotson, D. A.
Tagg, J. R.
Verdin, A.
Willison, Miss M. E.

Division 11

SOUTH WEST DIVISION

Chairman: Councillor C. Hebblethwaite, C.B.E.
Hon. Secretary: D. J. Barnett

The Annual General Meeting of the South West Division was held in the Pump Room, Bath, on Thursday, 3rd April 1975. Unfortunately this was the only meeting held during the year, due mainly to the problems arising from reorganisation, resulting in very few local authority members until comparatively recently.

The Divisional Council met in the morning and were able to get through a great deal of the routine business which had accrued during the last twelve months, and the full Division met in the afternoon.

The serving officers of the Division were re-elected together with the Divisional Representatives upon the Council. These are: Messrs. T. K. Aston, P. Draper, and the Hon. Secretary.

Reports were received on membership, air pollution monitoring and in particular the Avon/Gloucestershire/Somerset Monitoring Scheme, the Control of Pollution Act and a very full report on matters discussed in the Council and various Committees. A great deal of consideration was given to the problem of membership, and although there are fewer local authority members in the South West Division arising from reorganisation, there is a better geographical coverage. It was however, noted with some regret that the sole local authority representative from Cornwall could not influence the other authorities with whom it amalgamated upon reorganisation to join the National Society. It was decided that all authorities who are not members of the National Society for Clean Air should be contacted in the hope that some of them will in fact be recruited, and it was agreed that these approaches should be concentrated on District Councils.

D. J. Barnett
Hon. Secretary

MEMBERSHIP LIST

Local Authority Members

Bath City Council
Bristol City Council
Cheltenham District Council
Exeter City Council
Forest of Dean District Council
Gloucester City Council
Northavon Borough Council
Plymouth City Council
Poole Borough Council
Salisbury District Council
Stroud District Council
Taunton Deane District Council
Teign Bridge District Council
Tewkesbury District Council
Thamesdown District Council
Torridge District Council
Wansdyke District Council
Weymouth & Portland District Council
Woodspring District Council

Corporate Members

Burmah Oil Trading Ltd.
Central Electricity Generating Board, S.W Area
South Western Electricity Board
South Western Gas
J. D. Wilson & Partners

Individual Members

Barnett, D. J.
Colehan, J. E.
Davies, R. H.
Day, M. R.
Draper, P.
Hookin, Dr. L. E.
Lane, Dr. J. J.
Thomas, L. C.
Wakeley, R. W.
Watkins, E. R.
Whiting, G. C.

Division 12
SOUTH AND MID WALES DIVISION

Chairman: Cllr. C. Jenkins
Hon. Secretary: L. Morgan

The inaugural meeting of the re-organised South and Mid-Wales Division was held on the 29th May, 1975, at the Training Centre, B.P. Chemicals (International) Limited, Baglan Bay, Port Talbot.

The meeting was attended by 27 members and the following elections were made: Chairman, County Councillor Cyril Jenkins (West Glamorgan); Vice-Chairman, County Councillor D. F. Bevan (West Glamorgan); and Secretary/Treasurer, Mr. Lindsay Morgan (Afan Borough). Council of the Society: County Councillor J. H. Warren—to retire after 3 years (West Glamorgan); Mr. W. Bate, M.B.E.—to retire after 2 years (Cardiff City); and Councillor C. Summers—to retire after 1 year (Newport City).

12 members were elected to the Divisional Council and its is proposed that the further 6 places will be filled at a further meeting, taking into account industrial members.

A report was presented by the Secretary/Treasurer on the present finances and the Secretaries' Meeting held at Brighton earlier in the month.

Following the meeting the members were welcomed by Mr. Arthur Unwin of B.P. Chemicals (International). Following the welcome, Dr. Rowland Jenkins gave a short talk on the exhibition being held at B.P. for 6 months. The members then toured the exhibition.

Following the tour the members were entertained to tea and the Chairman thanked the Company and especially Mr. John Phillips, the Public Relations Officer, for his help in organising the visit.

L. Morgan
Hon. Secretary

MEMBERSHIP LIST

Sustaining Members

National Coal Board

Local Authority Members

Afan District Council
Blaenau Gwent District Council
Cardiff City Council
Cynon Valley District Council
Llanelli Borough Council
Islwyn Borough Council
Mid-Glamorgan County Council
Monmouth District Council
Neath District Council
Newport District Council
Preseli District Council
Rhonnda Borough Council
Rhymney Valley District Council
Swansea City Council
Taff Ely District Council
Vale of Glamorgan Borough Council
West Glamorgan County Council

Corporate Members

British Steel Corporation—Strip Mills Division
Coal Merchants Federation of Wales (Eastern Area)
South Wales Electricity Board
Swansea Port Health Authority
Wales Gas Board

Individual Members

Brownrigg, M. A.
Dearden, Mr. and Mrs. J.
Harrop-Griffiths, H.
Heard, M. J.
Perriman, R. J.
Steer, J.

National Society for Clean Air

ANNUAL REPORT AND ACCOUNTS

Year Ending, 31st March 1975

Clean Air Progress

The year under review has been a busy one for the Society, but it has also been a busy year for the environment and clean air. 1974 saw the enactment of two important pieces of legislation and the implementation of others. In July the Royal Assent was given to the Control of Pollution Act. This is the first statute addressed solely and specifically to the various forms of pollution and thus reflects the increasing concern and interest shown for the subject by all sections of the community. It is significant that this legislation, originally introduced as the Protection of the Environment Bill by one government, fell as a result of a change of government in February, 1974. But the succeeding government immediately re-introduced the bill under a new name, and it has now become law. Its provisions impose new duties and responsibilities on county councils, district councils and water authorities; and it alters the roles which these authorities have previously assumed. Inevitably, these changes in the law and the administrative arrangements for its enforcement will have a significant impact on those in trade, commerce and industry who will be called upon to comply with the requirements of the Act. The architects of the Act believe that if all its objectives are realised, various forms of pollution will be reduced, the environment will be afforded greater protection and the quality of life enhanced.

The Control of Pollution Act seeks to minimise pollution of land by waste products; it extends the existing law on water pollution to virtually all inland and coastal waters; it provides for a more extensive control of noise; and it augments the law relating to air pollution.

The Health and Safety at Work Act also received the Royal Assent in July, 1974. At first sight, this Act would not seem to have such an effect on the control of pollution. Obviously, as its name suggests the main purpose of this measure is to provide one comprehensive and integrated system of law dealing with health, safety and welfare of workpeople, and the health and safety of the public as affected by work activities. It is this latter requirement which could have a profound effect on the existing legislation regarding air pollution, for the Act sets up a Health and Safety Commission and an Executive to be generally responsible for administering 'the relevant statutory provisions' and for the Commission and the Executive to bring together all the various national inspectorates concerned with health and safety at work and with the general public as affected by work activities; and for the Commission and Executive to exercise the responsibilities which hitherto were exercised by different government departments under older legislation. This means that the Alkali and Clean Air Inspectorate are now responsible to the new Executive and the Commission, although it seems likely that the new Inspectorate will retain its identity as such, at any rate for the time being, within the Executive.

Nineteen-seventy-four also saw the implementation of the reorganisation of local government and the setting up of the Water Authorities. These two happenings, together with new legislation, will also have a considerable effect on the environment. It is not insignificant that most district councils, now responsible for clean air, have set up Environmental Health Departments.

Turning more specifically to clean air and the domestic front, my predecessor, Mr. Combey, stated in his report last year that there were no less than 364 smoke control orders confirmed for England, Wales, Scotland and Northern Ireland. But he said that it seemed unlikely that it would be possible to keep up such an impetus. This, in fact, has been the case and the total number of smoke control areas confirmed in the period under review throughout the United Kingdom was 179.

Mr. Combey also mentioned that consideration was being given to ceasing the differentiation between 'black' and 'white' areas for smoke control, and I am happy to say that as from September 23, 1974, the classification of 'black' and 'white' areas was abolished. From that date each area will be assessed on its merits. It is recognised that local authorities themselves are in the best position to assess local conditions, and it will be for them to take the initiative and institute the smoke control orders. Local authorities were therefore urged to review the progress made by their predecessors and to determine what further parts of their areas should be subject to smoke control and how soon this could be achieved. In this respect it seems clear that the Department of the Environment expect that almost all the former 'black' areas will be considered to be areas 'that should at some stage have smoke control, and that a substantial number of "white" areas will also be so regarded'. The Society welcomes these changes and hopes that in spite of known economic difficulties, smoke control will continue at a reasonable rate.

The Society

Because of changes in local government, all the old local authorities in England and Wales who were members of the Society ceased to be members and it was necessary for a recruiting campaign to be mounted to persuade as many as possible of the new authorities to become members of the Society. I am very happy to say that the response so far has been good. Nevertheless, there are still some notable omissions among the local authority members of the Society and we are taking steps which we hope will rectify this.

Financially, as the balance sheet shows, the Society is still in a reasonably strong position, but we, like everyone else, are affected by inflation and rising prices. The recent increase in postage costs is one that will affect us very considerably and we shall have to keep the position constantly under review. It may well be that we shall have to seek increased subscriptions from our members if our work is to continue at its present level.

Annual General Meeting

The Society's Annual General Meeting was held on Wednesday, July 3, at the Connaught Rooms, Great Queen Street, London, and was well attended. The Annual Report and Accounts were accepted and the President of the Society, Mr. H. B. Greenborough, was re-elected for a further year of office. Mr. R. A. W. Hollingdale was elected to succeed Dr. Turner in the office of Honorary Treasurer. The Annual Public Meeting followed in the business proceedings, and this was also well attended. The speaker was Sir Brian Flowers, FRS, Chairman of the Royal Commission on Environmental Pollution, and Rector of Imperial College, who addressed the meeting on 'The Work of the Royal Commission on Environmental Pollution'. Sir Brian's address was reproduced in full in the Autumn 1974 issue of *Clean Air*.

Annual Conference, Cardiff

The Society's Annual Clean Air Conference was held in Cardiff from October 14 to 18, 1974. Although a few delegates were possibly disappointed that the conference was not being held at a seaside resort as such, the very good attendance showed that most delegates attend for the conference rather than the place. Cardiff coped very well with the large influx, the Lord Mayor and Corporation were most helpful and hospitable, and the Conference was extremely successful.

The papers presented were not only particularly appropriate to the time and place, but were of a high standard. As a consequence, all sessions were extremely well attended and there was always a high level of discussion. The pattern of opening the Conference on the Monday evening was continued and the Assembly Room at the City Hall was comfortably full to hear the welcome and opening address from the Lord Mayor of Cardiff, Councillor Albert Huish, JP, and the second Presidential Address from Mr. H. B. Greenborough. The full text of the Lord Mayor's Address and that of the very fine Presidential Address by Mr. Greenborough were published in the Winter 1974 issue of *Clean Air*.

On the Tuesday morning, the venue was moved to the New Theatre, where new legislation was discussed following a very clear exposition by Mr. W. Bate, MBE, the City Environmental Health Officer of Cardiff. On the Tuesday afternoon, the first of four sessions on Environmental Pollution was held when Dr. Roland Jenkins of BP Chemicals International Ltd gave an interesting and informative paper on the technical aspects of co-operation between industry and local authority. On Wednesday, the theme of Environmental Pollution was continued when Road Traffic was considered. Mr. T. W. Heppel of the Building Research Establishment not only presented a very interesting paper, but gave a very informative and fascinating demonstration of traffic noise and its control. Dr. H. N. Stewart, of Warren Spring Laboratory, talked of the preliminary findings of the Five Town Survey and made particular reference to the work being carried out in Cardiff, a few hundred yards from the place where he was speaking.

On the Thursday morning, industry again came back into the picture when Mr. David Broadbent of the National Coal Board presented a paper about the coal industry and Dr. O'Connor of the British Steel Corporation pulled no punches at all when he presented the facts about the difficulties of the control of pollution with which the steel industry was faced. In the afternoon, the theme of environmental pollution was continued, but Professor Kenneth Mellanby of the National Environmental Research Council moved away from industry in particular and gave a very fine talk about wildlife and the effects of pollution. This was an open session, there was an encouraging attendance from school children and students from the South Wales area, and Professor Mellanby had a very enthusiastic audience.

The last session of conference was held on the Friday morning when the measurement of heavy metals in the atmosphere was discussed by two speakers. Mr. N. J. Pattenden, an atmospheric physicist from the Environmental and Medical Sciences Division of AERE, Harwell, discussed methods of sampling and some of the elementary principles involved; he was followed by Professor G. T. Goodman of Chelsea College, the University of London, who said that his students described him as 'cowshed chemist'. Professor Goodman gave a very interesting paper on the use of moss-bags as deposit gauges for airborne metals.

The weather in Cardiff followed the pattern of the autumn experienced all over the country last year and so was not very good, but it was only on the last day that heavy rain interfered with the comfort of delegates. On the Wednesday afternoon there were no less than six different technical visits as well as a tour of the Brecon Beacons for those more socially inclined. Concurrently with this, the Solid Smokeless Fuel Federation's Annual Golf Competition was held at Radyr and a few delegates played tennis.

There was a full programme for the ladies who, after a demonstration of cookery and a fashion display on the Tuesday morning, visited the Wye Valley. On Thursday there was a visit to the Welsh Folk Museum at St. Fagans and some ladies visited the new Hypermarket at Caerphilly. There was also a full social programme. The President gave a small dinner party on the Monday evening; on Tuesday, the Lord Mayor and Lady Mayoress and Corporation of Cardiff gave a Civic Reception for all delegates and their wives at the City Hall, and on Thursday entertained the members of the Council of the Society to luncheon at Cardiff Castle. On the Wednesday evening the South Wales Electricity Board gave a reception for the Honorary Officers, members of Council and Divisional Officers. The Castle was also the venue for my reception on the Thursday evening when I was very happy to entertain members of Council and their wives and other friends of the Society.

I think I can say with all honesty, that from all that has been heard there is no doubt that those who went to Cardiff considered it to be one of the best Conferences that the Society has held.

Annual Conference of the Scottish Division

The Annual Conference of the Scottish Division of the Society was held at St. Andrews on May 30 and 31, 1974. The weather was kind and the old town of St. Andrews was seen at its picturesque best.

On the evening of Wednesday May 29 the Scottish Division held its Annual General Meeting at which Mr. I. B. Anderson of Port Glasgow was elected President for the ensuing year. Following the meeting there was a social evening for all delegates.

The Conference proper started the following morning at the Town Hall where delegates were welcomed by the Provost of St. Andrews. The Conference was officially opened by the President of the Society, Mr. H. B. Greenborough, who set the keynote for the conference with a very fine address on clean air and the uses of energy with particular regard to oil from the North Sea. A technical session then followed when Mr. P. J. Comer presented a progress report on the Post Graduate Research Project on Air Pollution in west Central Scotland which had been sponsored by the Division. He was followed by Mr. A. W. C. Keddie, who spoke about the Forth Modelling Study sponsored by the Scottish Development Department. After lunch Professor G. Melvyn Howe, University of Strathclyde, and Mr. D. Hammerton, the Director of the River Clyde Purification Board, spoke on 'Pollution'. These two papers covered a very wide field and a lively dicussion followed.

The next day, Mr. Ian Kirkwood of the Institute of Heating and Ventilating Engineers presented a paper on 'The Future of Home Heating'; and Mr. T. D. Guthrie of the University of Dundee spoke on 'Noise as an Air Pollutant'. All the papers were very informative and some were extremely provocative.

The Conference was attended by some 120 delegates, and the Divisional Council of the Scottish Division are to be congratulated on arranging a programme with such wide coverage for them. The social side was not neglected. The Provost and Magistrates of St. Andrews entertained delegates at a sherry party in the Town Hall on Thursday and on Friday the Scottish Division were hosts at a luncheon. The fact that St. Andrews is the home of golf was not forgotten either. On the Friday afternoon the Solid Smokeless Fuels Federation very kindly organised a golf tournament on the Old Course.

Spring Meeting of the Northern Ireland Division

The spring meeting of the Northern Ireland Division of the Society was held on Tuesday April 2, 1974, in the Slieve Donard Hotel, Newcastle, Co. Down.

The delegates to the meeting were welcomed by Mr. Edward McVeigh, Chairman of Down District Council and the Conference was formally opened by Mr. Roy Bradford, the Minister for the Environment (Northern Ireland). Mr. Bradford stressed the importance of air pollution control and the usefulness of the Society in spreading publicity for the clean air cause and took the opportunity of widening the scope of his speech to include a broader view of the environment.

The first technical paper was presented by Mr. J. W. C. Keddie, Warren Spring Laboratory, who spoke of the National Survey and the extent to which Northern Ireland had been covered. Mr. K. H. Lynas, Chief Environmental Health Officer of the Department of the Environment for Northern Ireland presented a paper on 'Some Aspects of Pollution—a look back and forward'.

The final session of the meeting took the form of a discussion on the 'Energy Crunch'. Mr. D. G. Barrett, General Manager Coal Advisory Service, Mr. J. S. Gardner, Shell Marketing Ltd, Mr. J. M. Brown, Belfast Gas Manager and Mr. R. McCrory, Northern Ireland Electricity Service, each made brief statements and answered questions from the delegates.

At the end of the day's meeting, delegates were entertained at a reception by the Coal Advisory Service.

Clean Air Spring Seminar, 1975

The Fourth Clean Air Spring Seminar was held at the Gosforth Park Hotel, Newcastle upon Tyne, from March 18-20, 1975. The theme of the Seminar was Grit, Dust and Fume and to a large extent this was based on the work of the Department of the Environment's Second Working Party and its report on Grit and Dust Emissions.

Expectations and interest were obviously high since the Seminar received great support, so much so that the Society was repeatedly asked to extend the number of delegates who could be accepted. The final figure was 199.

The Seminar was opened by the Deputy Lord Mayor of Newcastle, Councillor Miss Steedman, who welcomed the delegates to the city. The first technical session proper was given a good start by Dr. G. G. Thurlow of the National Coal Board, who had been Chairman of the Working Party. Dr. Thurlow explained the general considerations with which the Working Party had had to contend and outlined the background of the report as a whole. This served to set the scene for what was to follow. Papers on the work of the various Panels then followed. Mr. G. Taylor of the Scientific Branch of the Greater London Council, discussed the work of the Incineration Panel: Mr. F. M. Shaw of the British Cast Iron Research Association presented a paper written in conjunction with Mr. P. J. Moseley of Messrs. Stanton & Staveley (BSC) about the work of the Cold Blast Cupola Panel; and Mr. E. B. Briggs of BP Marketing Ltd presented a paper on the work of the Dryers and Miscellaneous Furnaces Panel.

At lunchtime there was rather a scramble from those delegates who had not booked for technical visits, to obtain any vacant places. Great tact was needed by the staff dealing with this problem to try and please everybody. In the event, four parties of delegates visited American Air Filters Ltd, Associated Lead Manufacturers, the CEGB Stella South Power Station and the Municipal Incinerator at North Tyneside.

The session on the Wednesday morning was opened by Mr. A. Keating of Airflow Developments Ltd, who presented a paper on Instrumentation for Particulate Measurement. This was followed by a paper on the Need for Monitoring presented by Mr. A. Archer, the Chief Air Pollution and Noise Abatement Officer of the City of Birmingham. After the interval, Mr. W. Short, from NIFES, discussed the Practical Experience on Measurement of Grit and Dust emissions, and Mr. S. C. Wallin of Warren Spring Laboratory presented the paper written by himself and Mr. Clayton on Measurement and Standards for Pollutant Emissions from Stationary Sources.

More technical visits followed on the Wednesday afternoon, and these were again filled to capacity. Places visited were Alcan (UK) Ltd, the Municipal Incinerator at Gateshead, the NCB Coking Plant at Monkton and the Newcastle Polytechnic where demonstrations of research work being undertaken were given.

The attendance at the last session on Thursday morning was very large indeed which was extremely gratifying. Dr. Fuge, HM District Alkali and Clean Air Inspector, started things off by discussing the specific problems of the control of grit, dust and fume. Mr. H. Westwood of Howden Engineering Ltd described grit arrestors, and the use of the electrostatic precipitator at high temperature was described by Mr. K. R. Parker of Lodge Cottrell Ltd, who presented the paper prepared by himself and Mr. K. Darby.

After the interval, Mr. H. A. Edwards of Nailsea Engineering Ltd talked of the use of bag filters for dust arrestment and Mr. Max Beaumont of Messrs. F. E. Beaumont Ltd explained a new device for the extraction of solids from the flue gas stream of oil fired boilers. The final paper of the Seminar was presented by Mr. John Thurley of Messrs. John Thurley Ltd of Harrogate and he outlined the use of afterburning as a means of fume control.

This was undoubtedly a very full programme and it was clear from the lively discussion which took place at each session that delegates were extremely interested, and not only learned something from the papers but were able to contribute much to the success of the Seminar as a whole.

The technical visits obviously were much more popular than they had been in previous years and the rush at the last minute to secure places was entirely unexpected. However, it is gratifying to know that such visits are appreciated and they will undoubtedly form an important feature in future Seminars. We would hope however, that in future, delegates will return the forms with which they are provided and on which they can state their choice of visit, early.

On the social side, we are very much indebted to the Lord Mayor of Newcastle, Councillor Mrs. Collins, who so kindly entertained all delegates to an excellent cocktail party in the Mansion House on the Tuesday evening.

The Council and its Committees

Throughout the year, the Council and its Committees have met regularly in accordance with the established programme. At its first meeting, the Council were good enough to elect me to the office of Chairman, an office which I am pleased and proud to hold.

The Conference and Publicity Committee has, as ever, had a very active year in preparing programmes for the Conference in Torquay, the Spring Seminar in Newcastle and the forthcoming International Conference to be held at Brighton in October, 1975.

The Technical Committee has been engaged in the preparation of a pamphlet about exhaust fumes from motor vehicles and it is hoped that this will be published shortly. Work on the preparation of a glossary of terms used in air pollution and its control has now been completed; the glossary was published in the 1975 Year Book. The Technical Committee and the Society are very much indebted to Dr. J. S. S. Reay of Warren Spring Laboratory for the tremendous amount of work that he contributed to the production of this glossary.

The Parliamentary and Local Government Committee have had a full programme. Work with the Department of the Environment and the National Farmers Union on straw and stubble burning has continued. The NFU regulations have now been amended as requested by the Society and this is a step forward. A lot of work for the Committee has been entailed by the enquiry into the control of air pollution undertaken by the Royal Commission on Environmental Pollution. The Society was asked to give evidence to the Royal Commission and the Committee collected and prepared a written statement for submission to the Commission. Subsequently verbal evidence was given. The passing of the Control of Pollution Act has also resulted in work for the Committees; the Department of the Environment have issued a number of Consultation documents about noise and about the implementations of other sections of the Act and have asked for the Society's comments. All this work has been undertaken by the Parliamentary and Local Government Committee.

The work of the General Purposes and Finance Committee, although perhaps not as glamorous as that of some of the other Committees, is nevertheless of primary importance to the very existence of the Society. Evidence of the successful way in which the Committee have carried out their functions is reflected in the state of the Society's finances. That the recruiting of local authority members following local government reorganisation has proceeded satisfactorily is also a credit to the work of this committee. The very fact that the Society continues to function in the way that it does is a tribute to this day-to-day management work of the General Purposes and Finance Committee and I should like to express my thanks to Mr. Clancey, the Chairman and the Committee for the work that they have done.

The Divisions

The year under review has not been, on the face of it, a very active time for the Divisions. Because of local government reorganisation at the beginning of the year, the Divisions did not really know who many of their members were. This has meant a tremendous amount of work for the Honorary Secretaries of Divisons and the Divisional Councils. Much of this has been in the background and so there has not been the usual number of reports in *Clean Air* about specific activities of the Division. It is too early to say that all this work of reorganisation is now completed but a good deal of it has been achieved and the Divisions are now starting to become much more active. This is a welcome sign as the strength of the Society depends very much indeed on the work of the Divisions. The Divisions are the Society; that they are active is of supreme importance.

Publicity and Public Relations

Requests for assistance from the Society's Information Department and the Library have, if anything, increased during the last year. The range of requests is varied and embraces industry, the universities, colleges, schools and direct requests from school children themselves. At times it is difficult to keep up with the number of requests received but this is a good sign indicative of the position which the Society now holds.

Members of the Society and staff have presented papers at Conferences concerned with the environment in this country and overseas. In addition, members and staff have made broadcasts on national networks and from local radio stations. Lectures have been given to various organisations and to schools.

Our journal *Clean Air* has continued to be issued as usual and the Year Book, published annually, and which every year sees a wider circulation, has this year had a new look. I hope you all have seen it and have noted that the book now contains sections on noise, on water, on pollution of the land and on conservation. This is a change which indicates the widening of the Society's horizons as reflected in the new terms of reference which were agreed last year.

Of particular interest and importance was the second Sir Hugh Beaver Memorial Lecture, sponsored on this occasion by the Society, and which was delivered by Lord Ashby, FRS, former Chairman of the Royal Commission on Environmental Pollution, at the Livery Hall, Guildhall, London, on the evening of Tuesday, December 3, last. This was a memorable occasion and all those who were privileged to be present will long remember the very fine address by Lord Ashby. I realise, of course, that some members were unable to be there when the lecture was presented, but we were able to publish the text of the lecture in the Spring 1975 issue of *Clean Air*.

Other Activities

The Society has continued to enjoy good relations with the government on such matters as clean air legislation. We are very well represented on the Clean Air Council and I, myself, was very happy to be appointed to the Council recently. Members of the Society continue to serve on Working Parties appointed by the Department of the Environment to inquire into particular subjects connected with clean air. Recently some members of the Society were appointed to serve on the Royal Commission of the Environment in connection with the special study regarding air pollution which the Commission is carrying out. The Society continues to have very strong representation at the Standing Conference of Co-operating Bodies.

Financial Trends

Last year my predecessor Mr. Combey was able to record an upward tendency in the Society's income records. I am equally pleased this year to report that this tendency has continued and that the recruiting of new local authority members has been satisfactory. As I said earlier, however, there are still some notable gaps and efforts are being made to fill them as soon as possible.

Although the financial position as outlined in the statement of accounts may seem satisfactory at the moment there is no room for complacency. The Society is affected by inflation just like everybody else; prices and salaries continue to rise. We have managed to keep our subscriptions stable for a period of two years but it now seems that we may well have to review these and possibly ask members for increased contributions in the next year. Much of our work is carried out by correspondence and telephone and the new rates for postage and telephones are going to affect us severely.

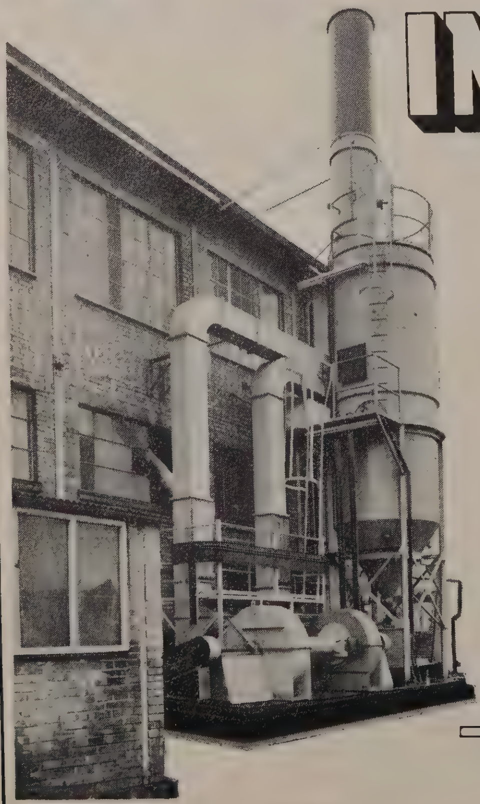
Conclusion

The Society has had a year of consolidation following the period of reconstruction and I feel that sound foundations have been laid for the future. However, we have not reached the time when we can sit back and enjoy the fruits of our labours. Much still remains to be done in the realms of clean air and the environment; much still remains to be done to ensure that the Society continues to make progress and to expand.

The demands on members of Council and on members of Committees have not been light but all such demands have been responded to most willingly and I would like to thank all of them including the Honorary officers for the way in which they have supported the Chair during my term of office. I would also like to thank the Secretary General and his small staff for the very great help that they have given.

The work accomplished during the past year has not been inconsiderable; it has been varied and rewarding. I feel sure it augurs well for the future.

Mary George,
Chairman



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THE NATIONAL SOCIETY FOR CLEAN AIR
(Company Limited by Guarantee—Incorporated January 1, 1958)
BALANCE SHEET AS AT MARCH 31, 1975

		31.3.75		*31.3.74*
	£	£	£	£
FIXED ASSETS (see Notes to Accounts Nos. 1 & 2)				
OFFICE MACHINES AND FURNITURE				
As valued by the Secretary General as at 1.4.72	1,910		*1,910*	
Additions at Cost	4,954		*4,180*	
	6,864		*6,090*	
Less Depreciation (over 5 years)	3,379	3,485	*2,006*	*4,084*
LIBRARY BOOKS				
At Nominal Value		100		*100*
		3,585		*4,184*
INVESTMENTS AT COST (see Note 3)				
Fixed Interest Stocks	3,270		*3,270*	
Ordinary Shares	9,253	12,523	*9,253*	*12,523*
CURRENT ASSETS				
Stock of Publications at Secretary General's Valuation	1,100		*1,100*	
Sundry Debtors	4,691		*4,011*	
Prepayments	204		*38*	
Bank Balances	22,801		*13,750*	
Cash in Hand	20		*44*	
	28,816		*18,943*	
LESS CURRENT LIABILITIES				
Sundry Creditors and Accrued Expenses	9,185		*5,993*	
Net Current Assets		19,631		*12,950*
Net Assets		£35,739		*£29,657*
Represented by:				
GENERAL FUND				
Balance at start of year		24,579		*20,104*
Surplus for the year		3,082		*4,475*
Balance at end of year		27,661		*24,579*
PREMISES FUND—brought forward	5,078		*2,078*	
Add Transfer during year	3,000	8,078	*3,000*	*5,078*
		£35,739		*£29,657*

Notes 1 to 6 form part of these Accounts.

R. A. W. HOLLINGDALE *Honorary Treasurer*
P. G. SHARP *Secretary General*

NOTES TO THE ACCOUNTS

1. *Lease*
   The Society bought the lease of its Brighton offices (which is for 14 years from November 15, 1965) and the cost of £2,000 was deducted from the Premises Reserve Fund.
2. *Office Furniture and Equipment*
   Records are not available to show the original cost of all furniture and equipment which was valued by the Secretary General as at 1.4.72 at £1,910 and has been included in the accounts at this figure. The valuation and subsequent purchases are being written off over 5 years.
3. *Investments*
   The market value of the Society's investments as at March 31, 1975 was £13,795 compared with £14,265 as at March 31, 1974, a decrease of £470.
4. *Surplus on Conference and Seminars*
   The Expenses deducted from the Income include 40 per cent of Salaries apportioned in the estimated ratio of the numbers attending the functions. No charge for salaries was made in the year to 31/3/74 and the figure for wages £14,489 is a gross figure. The figure £12,629 is a net figure after charging £8,419 to Seminars, etc.

5. *Commitments*
The Society was at March 31, 1975 committed to the publication of two issues of *Clean Air* at an approximate cost of £2,000.

6 *Divisions*
The 12 Divisions of the Society hold balances for local administration purposes which are not brought into these Accounts.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED MARCH 31, 1975

	£	Year 1974/75 £	£	*Year 1973/74* £
INCOME				
SUBSCRIPTIONS AND DONATIONS		25,142		*21,246*
SURPLUSES ON CONFERENCES AND SEMINARS (see Note 4)				
Conference—Cardiff		4,213		*8,546*
Seminars—Oxford		—		*571*
Sheffield		115		*2,566*
Newcastle-upon-Tyne		1,204		—
Envitec 1973 (Germany)		—		*71*
SALES OF PUBLICATIONS		3,315		*3,089*
INVESTMENT INCOME				
Dividends (Gross)	1,242		*1,095*	
Bank Deposit Interest	1,985	3,227	*978*	*2,073*
		37,216		*38,162*
EXPENSES				
RUNNING COSTS				
Salaries and Wages (see Note 4)	12,629		*14,489*	
Staff Pension Scheme	1,333		*965*	
Rent, Rates, Light and Heat	1,785		*1,542*	
Insurance, Travel, Cleaning and General Expenses	5,197		*4,325*	
Depreciation: Office Equipment and Furniture	1,373		*1,217*	
Stationery Supplies	880		*988*	
Provision for Doubtful Debts	—		*1,372*	
	23,197		*24,898*	
CLEAN AIR AND YEAR BOOK				
Printing, Postage, etc.	9,234		*7,117*	
Less Advertising Receipts	2,592		*2,791*	
	6,642		*4,326*	
INFORMATION, PUBLICITY SERVICES AND COST OF PUBLICATIONS	970		*1,161*	
DIVISIONAL GRANTS (see Note 6)	325		*302*	
	1,295	31,134	*1,463*	*30,687*
EXCESS OF INCOME OVER EXPENDITURE		6,082		*7,475*
LESS TRANSFER TO PREMISES RESERVE		3,000		*3,000*
BALANCE TRANSFERRED TO GENERAL FUND		£3,082		*£4,475*

REPORT OF THE HONORARY AUDITORS OF THE NATIONAL SOCIETY FOR CLEAN AIR

We have examined the Balance Sheet and annexed Income and Expenditure Account. In our opinion the Accounts comply with the Companies Acts, 1948 and 1967 and give a true and fair view of the state of the Society's affairs at March 31, 1975 and of its surplus for the year ended on that date.

City Gate House,
39/45 Finsbury Square,
London EC2A 1AE.
May, 1, 1975.

GEO. LITTLE, SEBIRE & CO.,
Chartered Accountants

SECTION 2

AIR POLLUTION

Page

Glossary of Terms Relating to Air Pollution 24
An Outline of the Law Relating to Air Pollution 36
  Control of Smoke 37
  Control of Chimney Heights 42
  Control of Grit, Dust and Fume Emissions 45
  Miscellaneous Provisions 51
  Control of Pollution Act 1974 52
  Health and Safety at Work Act 1974 53
  Road Traffic Pollution Law 57
The Ringelmann Chart 58
Smoke Control Areas 60
The History of Air Pollution and its Control in Great Britain 65
Major Smog Disasters 66
The Clean Air Case 67
The Cost of Air Pollution 68
Estimates of Air Pollution in the United Kingdom in the year 1973 .. 69
Comparison of Air Pollution Statistics 71
Garden Bonfires 73
The Use of SI Units in Environmental Technology 74
British Standards Relating to Air Pollution 77

GLOSSARY OF TERMS RELATING TO AIR POLLUTION

This Glossary of terms is intended to help members of the Society and others interested in Air Pollution to understand technical articles and lectures, etc. on the subject. After some thought it has been decided not to produce a list of precise definitions since to many non-technical people these can sometimes be as incomprehensible as the terms being defined. Instead, an attempt has been made to indicate the general concepts involved in many technical terms so that people can get the feel of these terms in the context in which they occur.

For those seeking precise definitions the World Health Organisation has a much larger Glossary in preparation. This should be published in 1976.

Members of the Technical Committee have offered comments and suggestions during the drafting of the Glossary, but the main tasks of selecting items for inclusion, for writing the definitions and for final editing, have been undertaken by Dr. Reay of Warren Spring Laboratory. The Technical Committee therefore wish to acknowledge with gratitude the considerable personal effort that Dr. Reay has expended on the preparation of the Glossary for which he may rightfully take most of the credit.

Abatement
Reduction or lessening (of pollution) or doing away with (a nuisance).

Absorption
1) The taking up usually of a liquid or gas into the body of another material (the absorbent). Thus for instance an air pollutant may be removed by absorption in a suitable solvent.
2) The taking up of radiation by a material it encounters or passes through. This can be the basis of measuring a number of substances.

Acid
A substance which, in solution in water, splits up to some extent with the formation of hydrogen ions. Strong acids are those which split up to a large degree; they are usually corrosive. Acids neutralise alkalis (q.v.) with the formation of salts.

Acid Dewpoint
The temperature at which dilute sulphuric acid appears as a condensate when a flue gas containing sulphur trioxide is cooled. This is related to the moisture and sulphur trioxide content of the flue gas.

Accuracy
The nearness of a measurement to the true value of the thing being measured (cf. precision).

Acute
Used in relation to the effects of certain concentrations of air pollutants to describe a response coming rapidly to a climax (cf. chronic).

Adiabatic
Without loss or gain of heat.

Adsorption
A phenomenon in which molecules of a substance (the adsorbate) are taken up and held on the surface of a material (the adsorbent) (cf. absorption).

Aerosol
Finely divided solid or liquid particles suspended and dispersed in a gas as in the case of a mist, fog, haze or smoke.

Afterburner
A burner fitted after the main point of fuel combustion in stationary plant or a vehicle to produce more nearly complete combustion and less pollution. It may also be a burner fitted to incinerate polluted process gases.

Agglomeration
The clustering or adhering together of a number of small particles to form something (an agglomerate) which then acts as a larger single particle.

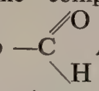
Aggregate
There are two common meanings
1) Similar to agglomerate (q.v.) but probably less strongly bonded;
2) Sand and rubble used to make concrete.

Air Quality
Air quality usually refers to the concentration in air of one or more pollutants. For many pollutants air quality will be found to be expressed as a concentration over a certain period of time eg $\mu g/m^3$ over 24 hours.

Air Quality Criteria
See Criteria

Air Pollution
See Pollution

Aldyhydes
Organic compounds containing the group



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A number of them have an unpleasant smell, eg in diesel exhaust, and can be irritant to nose and eyes; many can be poisonous.

Alkali/Alkaline
A substance which, in solution in water, splits up to some extent to give rise to an excess of hydroxyl over hydrogen ions. The solution is said to exhibit alkaline properties. Alkalis neutralise acids with the formation of salts.

Alkali Inspectorate
The control of many of the major industrial processes in the UK capable of polluting emissions is vested in H.M. Alkali and Clean Air Inspectorate which enforces the Alkali Etc Works Regulation Acts in England and Wales and in H.M. Industrial Pollution Inspectorate for Scotland.

Allergy
The reaction of the living body to a substance or substances to which certain body cells are supersensitive. The final effect may take the form of local inflammation or tissue damage.

Alveoli
Small pits or depressions on the surface of an organ. In the air pollution literature alveoli refer to very small terminal air sacs in the lung where gaseous exchange takes place between the blood and the air.

Ambient
Surrounding. Used to describe air pollution concentrations in the open air

as against, say, at the point of emission or indoors.

Amenity
Basically this means pleasantness. In air pollution it usually refers to the general quality of the environment as society perceives it distinct from hazards of air pollution which can cause physical damage.

Anemometer
An instrument for measuring wind speed.

Anoxia
A deficiency of oxygen—in the blood or thereby in body tissues.

Anthracite
A high calorific value coal yielding little ash and volatiles—hence low smoke production. It is slow-burning and not normally used on open fires. It is cleaner to handle than most other coals.

Antibody
A specific substance released into the body's system in response to invasion by an antigen (q.v.).

Anticyclone
The condition of atmospheric pressure distribution in which pressure increases towards the centre. Usually associated with fine, calm weather and with fog in winter.

Antiknock Additives
Antiknock additives to petrol allow its use in higher compression ratio engines than otherwise permissible and with greater thermal efficiency without the phenomenon of 'knock' (q.v.). The additives are commonly organic lead compounds.

Antigen
A foreign substance, usually a protein, which, when introduced into the body, causes the production of an antibody (q.v.).

Aromatics
These are hydrocarbon compounds containing as part of their structure rings of atoms such as are found in benzene and other similar cyclic molecules.
In petroleum products it distinguishes these hydrocarbons from those which are chainlike in structure (paraffins). Aromatics tend to have higher octane ratings (q.v.).

Arrestment/Arrester
Arrestment of a pollutant from a gas stream is the process of its trapping or removal by an arrester or cleaning device.

Asbestos
Natural material of a fibrous nature with a number of uses, eg building materials, brake shoes, depending on its resistance to high temperatures and its thermal insulation properties. Long term exposure to airborne asbestos dust can lead to asbestosis, a lung disease.

Ash
The nonvolatile inorganic residue left when a fuel is burned completely.

Atmosphere
The atmosphere is the envelope of air around the earth.
An atmosphere may refer to a much more local volume of air without implying the quality of that air. It may also be found as an obsolescent unit of pressure.

Atomic Power
By this or nuclear power is normally meant electricity generated in a power plant for which the source of heat is nuclear fission.

Atomisation
The process by which a solid or liquid is reduced not to atoms but to very small particles or droplets as in a fine spray. Good atomisation of fuel oil, allowing increased fuel/air mixing, is necessary to obtain satisfactory combustion. Atomised pollutants may persist suspended in air because of their small particle size.

Authorised Fuel
In the United Kingdom the regulations consequent upon the Clean Air Act 1956 specify performance characteristics for fuels (mainly smoke production) on the basis of which they may be authorised for use in smoke controlled areas.

Bacharach Smoke Scale
A scale of 10 shades from white to black for the assessment of smoke in flues. A smoke stain obtained by sampling flue gases through a filter paper in a prescribed manner is graded according to the scale.

Background
If a local atmosphere is polluted by some substance from a particular local source then the background level of pollution by that substance is the concentration of that substance there would be in that air without that local source of pollution.
Sometimes the word is used to mean the concentration of the substance some distance from the particular source and therefore largely uninfluenced by it.

Bar
The SI unit of pressure equal to 10^5 Newtons/m^2 or 10^6 dynes/cm^2.

Beaufort Scale
A scale from 0 to 17 for estimating and reporting wind force in which 0 is calm and 12 a hurricane.

Benefit/Cost
The Benefit/Cost ratio seeks to compare the benefits of a particular action with its cost. In the case of antipollution expenditure the benefits have to be assessed of the effect of reduced pollution. A benefit/cost ratio of 10:1 implies that for every £1 spent on improving the pollution situation, the benefits can be valued at £10.

Beryllium (Be)
A light metal used in several industries, eg nuclear power, and products, eg fluorescent light tubes. It is highly toxic. Air pollution by beryllium-containing dust has been known to occur at or near points of production and use and in the disposal of products.

Best Practicable Means
See Means.

Bituminous Coal
The most general form of British coal, it produces a relatively high proportion of volatile hydrocarbons (over 13%) and, burned in the traditional domestic grate, it will give rise to smoke.

Boundary Layer
Where a fluid flows past a physical boundary, the boundary layer is that part of the fluid extending from the boundary into the bulk of the fluid in which the motion of the fluid is much affected by the frictional drag at the boundary.
The earth's atmospheric boundary layer is typically the lowest 1000m or so of the atmosphere.

Bronchitis
Basically bronchitis is inflammation of the bronchi, the two branches of the air pipe leading to the lungs. It is a reaction of the mucosal lining to an irritant. The word is less exactly, but more widely, used to describe a variety of lung disablements which can be associated with air pollution—particularly smoking.

B.S.I.
British Standards Institution. The national standards setting body in Britain. Among the things it specifies are products and methods of test or measurement.

Btu
British Thermal Unit. A unit of energy approximately equal to 1055 Joules or 0,252 kilocalories. It is the amount of heat required to raise the temperature of 1 lb of water by 1 Fahrenheit Degree (60–61°F).

Buffer Capacity
The capacity of certain solutions to oppose a change in properties eg particularly acidity when acid or alkali is added.

Buoyancy
The tendency of material immersed in a fluid to float up. In air pollution it is frequently applied to the tendency or otherwise of the hot gases emitted from a chimney to rise in view of their lower density relative to that of the surrounding air.

Cadmium (Cd)
A metal having toxic compounds. It occurs in minerals used for zinc production and is thus a potential air pollutant around zinc smelters. As with lead, human intake of cadmium can be from food and drink as well as the air.

Calm
The air is described as calm in meteorological terms if the wind speed is less than 1 knot or 0,2 m/s.

Calorific Value
A measure of the heating quality of fuels, usually expressed as available heat units, from the complete combustion of unit mass of fuel; eg Btu/lb, kJ/kg or MJ/kg for solid or liquid fuels and Btu/ft^3 or MJ/m^3 for gaseous fuels. There are gross and net calorific values for hydrogen-containing fuels depending respectively on whether the heat of condensation of water produced is included or excluded.

Carbon Dioxide (CO_2)
This is the gas which is formed by complete combustion of the carbon in any fuel. It also arises from natural sources, and is removed from the atmosphere by plants and by solution in water, mainly in the sea. An excess of carbon dioxide can be suffocating in confined circumstances but it is rarely found in hazardous concentrations in the open air.

Carbon Monoxide (CO)
This colourless odourless gas is produced by the incomplete combustion of carbon in any fuel. It also arises from natural sources. It is toxic at sufficient concentrations. Generally it is present only at low concentrations in the atmosphere. A major man-made source is the petrol engine which can give rise to raised concentrations in busy streets. Smokers expose themselves to higher concentrations.

Carburation
The mixing of air with a volatile fuel to provide the combustible mixture for use in the internal combustion engine. The device in which this occurs is the carburettor.

Cascade Impactor
An instrument to sample particulates and separate them into a number of successive fractions in different size ranges.

Catalyst—catalytic combustion
A substance which, though not itself permanently changed, alters the rate of (usually speeds up) a chemical reaction. Catalysts are often used to speed up combustion or allow combustion to occur at a lower than usual temperature.

CEC
Commission of the European Communities. The civil service of the EEC (q.v.), it is assigned the task of preparing regulations and directives etc.

Celsius
The practical SI temperature scale. Although defined differently, it is for all practical purposes equivalent to the Centigrade scale in which the freezing point of water is 0° and the boiling point of water is 100°.

Cenosphere
Small hollow spherical particles arising from the incomplete combustion of liquid and solid fuel droplets or particles.

Centrifugal
The adjective describing the outward force on an object circling a point eg if one whirls a ball on a string, the tension on the string is related to the centrifugal force on the ball.

Cetane No.
A rating of the ignition quality of diesel fuel, eg readiness to initiate combustion upon injection into the hot compressed air; originally the percentage of cetane in a mixture of cetane and 1-methylnaphthalene having the same ignition quality as the fuel under test. Cf octane rating.

Chromatography
A method of separation of mixtures, and hence analysis, based on selective adsorption. Particularly used to separate organic compounds.

Chronic
Referring to damage or effects of air pollution, particularly to health, it implies lasting or long term damage as against acute effects (q.v.).

Chrysotile
A fibrous mineral commonly a component of commercial asbestos (q.v.).

CGS
Centimetre-Gramme-Second—a system of units being superceded by the SI system (q.v.).

Classification
Separation of items into types. In relation to particles it implies the process of separating them into fractions of defined size range.

Clinker
Aggregated or sintered ash formed when the ash is heated strongly in a furnace.

Coal Equivalent
A method of describing the combustion energy of a given weight of fuel in terms of the weight of a standard coal which would produce an equal amount of heat energy.

Coalite
A trade name for a semi-coke smokeless fuel produced by low temperature carbonisation of coal.

COH
Coefficient of haze. This is an American unit for measuring smoke stains (q.v.) which depends on the reduction of light transmission through the filter after it has collected the smoke sample. Its object is to measure haze over a distance of 1000 feet.

Cohort
A group banded together. In medical studies a group of people with certain similar characteristics, age or environment, which makes them particularly suitable for study of some variable.

Coke
A smokeless solid fuel traditionally formed from coal by destructive distillation. It may also be produced from oil.

Cold Front
The sharp boundary between two extensive air masses where cold air is replacing warm air.

Combustion
The chemical combination of oxygen with fuel (combustible matter) with rapid heat evolution so that the temperature rises.
The products of combustion are the oxidation products of the components of the fuel. Thus hydrocarbons produce carbon monoxide, carbon dioxide and hydrogen oxide (water). Combustion of the sulphur in fuels produces sulphur dioxide.

Concentration—see also ground level
The amount of a substance in a given volume. The most general form for air pollution is $\mu g/m^3$ ie micrograms or millionths of a gram contained in a cubic metre of air.

For gaseous pollutants a common alternative is p.p.m.; the number of parts by volume of the pollutants in one million parts of the total gas.

Confidence Limit
A statistical expression. Confidence limits of x per cent mean that there is an x per cent chance of the value of a variable falling between the limits so defined.

Contaminant/Contamination
Common synonyms for pollutant/pollution indicating the presence of a foreign component.

Continuous Sampling
Uninterrupted sampling of air, usually at a fixed rate. Where the sample can be analysed continuously, the stream of gas may be passed through the measuring instrument continuously. Otherwise the sample is collected in an uninterrupted fashion for a given period and the total sample is finally analysed to give the mean composition of the air over the whole period.

Convection
The transfer of heat in a fluid by flow of parts of the fluid at different temperatures. Convection currents can be set up in air with the rise of hotter, less dense parts and the downward flow of cooler, more dense parts.

Correlation
A mathematical term describing the relationship of one variable factor to another.
A correlation coefficient is a measure of the degree of association between corresponding values of two variables. A value of zero indicates the absence of correlation. Values between zero and 1 (positive or negative) indicate the degree of correlation (direct or inverse).

Cost/Benefit
See Benefit/Cost.

Cracking
The refinery process of chemically breaking up the heavier petroleum distillates to obtain greater quantities of lighter products.

Critical Temperature and Pressure
The critical temperature of a given gas is the temperature above which it cannot be liquified. The pressure at which the gas may just be liquified at its critical temperature is its critical pressure.

Criteria (Air Quality)
Information used as guidelines for establishing air quality standards or goals. Often in the form of dose/response relationships.

Crocidolite
An asbestos mineral—see Asbestos.

Crude Oil
The raw mineral hydrocarbon oil obtained from oil wells. For commercial use it is refined and distilled into various fractions and products.

Cryptic
Literally hidden. In referring to pollution damage it implies damage without visible signs eg reduced growth in plants.

Cubic Metre (m^3)
See Metre.

Cumulative (Sampling & Effect)
Sampling—a system in which the sample is accumulated over time either by being taken continuously or for periods at regular intervals to give a single sample whose composition is regarded as representative of the whole period of its accumulation.
Effect—increasing or building up with successive or continuing exposures.

Cupola
A firebrick-lined shaft furnace used in melting metals, often pig iron (with or without scrap) for castings. Metal, coke and flux (if used) are charged at the top and air is blown in near the bottom. Its operation involves the emission of iron oxide fume which has to be arrested.

Cycle (Driving)
See Driving Cycle.

Cyclone—device & atmospheric condition
1) A mechanical device for the removal of particles from gas streams by centrifugal force imparted by a whirling motion of the gas inside the device.
2) A natural wind system rotating around a centre of low barometric pressure.

Decay
In air pollution the decay of an airborne pollutant usually implies the rate at which it is lost from the atmosphere, eg by absorption or precipitation, including its loss by transformation into some other chemical.

Degree Day
The condition of a mean of one degree difference in temperature between the outside temperature and a given base temperature (the figure usually adopted in Britain is 60°F (15·6°C) over one day of 24 hours is termed "one degree day". The heating requirements (ie fuel consumption) of a building over a period are often taken to be proportional to the number of degree days, ie the sum of the degree day values for the days of the period.

Density
Basically the mass of a unit of volume of a material, eg grams per cubic centimetre or pounds per cubic foot.

Deposit Gauge
An instrument designed to assess the rate of deposition of material from the air. In most instances the gauge receives material through a horizontal opening and the results can be expressed in terms of amount deposited on a given area in a given time. There are two BSI Specifications for deposit gauges, BS 1747:Parts 1 & 5.

Desorption
The removal of absorbed or adsorbed material.

Desulphurisation
Literally the removal of sulphur. To reduce sulphur dioxide emissions it is possible to use *fuel desulphurisation* so as to reduce the sulphur present in the fuel when it is burned, or *flue gas desulphurisation* in which the sulphur dioxide is removed from the gases formed by combustion.

Determination
In analysis a determination is a measurement of the amount of something.

Dew Point
The temperature to which a particular sample of air has to be cooled before it starts depositing dew. It is a measure of the air's moisture content, the higher the moisture content the higher the dew point.

Diesel
The Diesel engine is a type of internal combustion engine in which air is heated by compression so that combustion occurs when the fuel is injected. It thus employs compression ignition as against spark ignition which is the principle of the petrol engine. The type of petroleum distillate used by the diesel engine is referred to as diesel oil or derv.

Diffusion
On the scale of molecules, diffusion is a mixing of substances caused by molecular motion. In meteorology it implies the apparently random exchange of small bodies of gas between adjacent regions in the atmosphere.

Disperson
In the sense in which it is used in air pollution matters, dispersion describes the way in which a pollutant spreads from its points of emission and becomes diluted in the atmosphere.

Disposal
In relation to wastes it is the final act or system of getting rid of a waste.

Dissociation
The splitting of molecules into simpler molecules, atoms or groups of atoms or ions.

Distillate
Fundamentally the distillate is any product obtained by vaporisation from a still or distillation apparatus. The term distillate fuel is often applied to a fraction heavier than petrol or to paraffin (kerosine) or to gas oil.

Diurnal
An adjective describing the variations in some parameter during a typical day.

Dolomite
A magnesium calcium carbonate mineral akin to limestone. It has been used because of its alkalinity for the removal of sulphur oxides from flue gases.

Dose
The amount taken or received. In the assessment of pollution effects an important factor is the dose/response relationship for any exposed individual or organism.

Downwash (Downdraught)
A downward air current (downdraught) to the lee of a chimney or building may cause the descent (downwash) of smoke or other emissions below the level of their emission.

Driving Cycle
In relation to the testing of motor vehicles, particularly to estimate their pollution emission characteristics, they may be made to perform standard driving cycles which are fixed patterns of steady speeds, accelerations and decelerations typical of some particular form of driving, eg urban use.

Dust
According to the British Standard BS.3405 dust is defined as small solid particles in the size range 1 to 75 um in diameter. Above this size the particles would come into the category of grit. Below about 1 μm the particles, if airborne, would tend to remain in suspension rather than settle out under their own weight.

Dustfall
The rate at which dust is deposited from the air.

ECE
The Economic Commission for Europe. A body for region-wide economic co-operation within the framework of the United Nations. Its membership consists of all the European members of the United Nations together with the United States of America. It proposes various standards such as emission standards for motor vehicles.

Ecology
The relation or interacting of living systems with each other and their surroundings.

Eddy
A fluctuation of the motion of a fluid, usually superimposed on the mean flow of the fluid (see also Turbulence).

EEC
The European Economic Community—the Common Market whose members are Belgium, Denmark, Eire, Federal Germany, France, Holland, Italy, Luxembourg and the United Kingdom.

Effluent
Literally anything which flows out or is discharged. Usually applied to the discharge of a waste material into a stream, sewer or to the air.

Efflux Velocity
The speed with which something is emitted from an orifice, eg gases from the top of a chimney.

Effective Chimney or Stack Height
The effective height of a chimney is the sum of its actual physical height and the rise of the emitted plume caused by its buoyancy (q.v.) and efflux velocity (q.v.).

Electrostatic
Generally describing something having an electrical charge. An elextrostatic precipitator is a system for removing particles from a gas by giving them an electrical charge and then getting them to adhere to a plate having an opposite electrical charge.

Elutriation
A process for separating fine particles into sized fractions by their rate of gravitation in a rising stream of fluid.

Emission
The material being discharged into the atmosphere. An emission is often expressed as an emission rate eg mass/unit time or an emission concentration eg volume or mass of material per unit volume of total emitted gas.

Emission Standard
The amount of pollutants permitted to be discharged from a pollution source. Emission standards are commonly described in one or more of the following ways:

a) weight of pollutants over a certain time eg lb/hr, kg/hr or tons/day;
b) weight of pollutants per weight of material processed eg 40 pounds per ton ($\sim$2%);
c) weight of pollutant per unit volume of discharged gas eg grains/ft^3 or mg/m^3.
d) the volume of pollutants (if gaseous) per unit volume of discharged gas eg parts per million.

Emphysema
Pulmonary or lung emphysema is an over-distension or swelling of the lung air spaces owing to destruction of the alveoli which diminishes the area for exchanging oxygen and carbon dioxide between the air and the blood.

Environment
Literally surroundings; can apply to the indoor or working conditions but commonly refers to man's total surroundings, natural and manmade.

Epidermis
The outermost layer of skin of animals and some vegetable matter, eg leaves.

Epidemiology
The scientific study of the frequency and distribution of a disease within a population and often extended to include the relationship with external factors such as air pollution.

Equivalent Diameter
This has several technical meanings. In relation to airborne particles it is used to describe the way in which a particle behaves namely as if it were a sphere of a certain diameter (and often of a standard density).

Error (Sampling/Analytical/Random)
Colloquially an error is a mistake. In several scientific fields it is used to denote the difference between a measured value of something and its true value.
Sampling error represents the deviation of the properties (eg composition) of a sample from those of the whole.
Analytical error represents the deviation of the analytical result from the true composition of the thing being analysed.
Random error is where the measured values are likely to be distributed in an unbiased fashion above and below the true value.

Exposure
A measure or description of the extent to which an object or organism has been subjected or exposed to a particular pollutant.

Extrapolate
To estimate the value of something beyond the range in which it has been measured, eg estimating pollution levels in the near future from a number of values over past years. Cf. interpolate.

Filter
A medium for separating solids or liquid particles from fluids or solid particles from other particles of different size depending on the type of filter used.

Flame Ionisation
Certain gaseous compounds, notably those containing carbon, can be estimated by the extent to which they are

ionised in a hydrogen flame. The technique is called flame ionisation detection. (F.I.D.).

Flashpoint—open and closed
The lowest temperature at which a liquid fuel will give off a flammable vapour which will burn momentarily. There are several methods of measuring the flashpoint eg using an open or closed cup for the test.

Fluidised Bed
A chemical engineering term to describe a bed of solid particles through which air or some other gas is blown upwards in such a fashion as to support the particles and make them act in many ways like a liquid. Furnaces have been devised in which oil or powdered or granulated coal can be introduced into such a (heated) bed where it will burn evenly and produce an even temperature throughout the bed.

Fluorine/Fluorides (F)
In air pollution fluorine is often used to cover both the element of that name and its compounds, mostly fluorides. Fluorine and its soluble compounds can be highly toxic. It is a pollutant particularly associated with brick and aluminium production.

Fly Ash
The finely divided particles of ash readily entrained in flue gases arising from the combustion of fossil fuels (mainly coal). The particles of ash may contain partly burned fuel.

Fog
Atmospheric obscuration caused by liquid water droplets. In meteorological terms a fog imples a visibility of less than 1 km. (cf. haze).

Fossil Fuels
A general term covering coal, oil, natural gas etc which are fuels derived from organic deposits in past geological periods. They consist mainly of carbon and hydrocarbons. By comparison wood and nuclear fuel are not fossil fuels.

Freons
A range of hydrocarbons with hydrogen replaced, partly or totally, by fluorine or chlorine. These wholly man-made compounds are used as refrigerants, in fire extinguishers and as aerosol propellants. They are thus being found widely at very low concentrations in air where they have a long life.

Frequency Distribution
A graphical way of showing the frequency of occurrence of values of some parameter against the values of that parameter.

Fume
Very fine solid or liquid particles 0·001 to 1 μm in diameter arising from chemical reactions or condensation of vapour (often metal vapour).
The word fumes is commonly used to imply unpleasant and smelly airborne effluents.

Fumigation
When pollution from an emitter has been trapped under an inversion layer, it is sometimes brought rapidly to ground level with minimum dilution by turbulence as the inversion breaks up. This is called fumigation.

Gas Oil
A liquid petroleum distillate having a viscosity and distillation range between paraffin (kerosine) and light lubricating oil. It is in the same boiling point range as diesel oil. Often used for heating purposes, it has a relatively low sulphur content.

Grab—sample
A sample taken or grabbed at a single point in time rather than accumulated over a period and thus it is representative only of the conditions at the particular time of sampling. Snap sample has a similar meaning.

Grain
The word has a number of meanings in common use. In air pollution work it is often encountered as a unit of weight. This old apothecaries' unit is still used in certain regulations in describing permissible concentrations (grains/ft^3) of pollutants in process emissions.
1 grain is approximately 0·0648g.
1 grain/ft^3 is approximately 2·3g/m^3.

Gram (g)
The gram is the metric unit of mass. One thousand grams, a kilogram (kg) is the basic SI unit of mass. A milligram (mg) is a thousandth of a gram. Air pollution levels are often expressed in millionths of a gram (microgram or μg) per cubic metre (q.v.).

Greenhouse Effect
The name given to the retention of heat by the earth and the atmosphere owing to carbon dioxide in the air being "transparent" to incoming short-wave solar radiation but "opaque" to longer wave radiation back from the earth in the same way that glass causes heat retention in a greenhouse.

Grit & Dust
The particles of solid in the air or flue gases which fall out or deposit under their own weight comprising dust (q.v.) and grit, which implies larger particles which fall out very rapidly. The British Standard BS.3405 categorises particles of diameter greater than 75 μm as grit.

Ground Level Concentration
The concentration (amount per unit volume) of a pollutant in air between ground and about 2 metres above the ground i.e. at breathing level. Where concentrations do not vary much with height it may be more convenient to make measurements at a height greater than 2 metres.
Sometimes abbreviated to g.l.c. which is also used for gas liquid chromatography.

Guideline—air quality
Air quality guidelines indicate levels and durations of air pollution by certain substances above which effects on materials, vegetation or health are produced. They are thus guides to desirable air quality.

Haze
A state of the atmosphere in which visibility is restricted, owing to the presence of very small dry suspended particulates which make one describe the air as hazy.

Heavy Metal
A term loosely used to describe not only such dense metals as lead but a whole range of elements, not all of them metals, which may, as suspended and deposited particulates, contaminate our environment eg lead, cadmium, chromium, nickel, cobalt, iron, vanadium, germanium, selenium, molybdenum, manganese, arsenic, zinc, beryllium. Since it is their toxicity which is often of concern, they are sometimes described collectively as toxic metals.

Histogram
A form of diagram showing the frequency of occurrence of values of a variable in various ranges. Columns or rectangles proportional to the frequencies of occurrence are set on a scale showing the ranges.

Humidity/Relative Humidity
The moistness or water vapour content of the atmosphere is its humidity.
Relative humidity is the moistness of the air as a percentage of the moistness of air when it is saturated with water vapour at the same temperature.

Hydrocarbon
Hydrocarbons are chemical compounds made up of only hydrogen and carbon. They are classified into a number of types according to their internal structures or ratio of carbon atoms to hydrogen atoms.
Hydrocarbons are the basic compounds in fossil fuels.

Hydrogenation
The process of adding hydrogen chemically to a substance. This is nowadays a major part of the process of refining crude oil.

Hydrogen Sulphide (H_2S)
A gas with the characteristic smell of rotten eggs. It is highly poisonous at all but the lowest concentrations. It is formed naturally, eg by volcanoes, but is also the product of various industrial processes whose emissions are controlled under the Alkali Act.

Hygrometer
An instrument for measuring the humidity of the air.

IEC
International Electrotechnical Commission.

Immission
Strictly this means intake by a receptor of pollution. Since this is often related to the concentration of the pollutant in the air there has been a tendency to speak of the immission concentration or even immission as the same as ground level concentration.
The word is a nuisance particularly since it is difficult to distinguish in normal speech from emission.

Ingestion
The taking in of substances to the stomach.

Instantaneous—sampling—analysis—peak
Instantaneous sampling implies sampling at one point in time rather like grab sampling (q.v.).
Instantaneous analysis usually refers to a pollution measuring system in which the analysis is so quick that the results represent the current situation. An instantaneous peak refers to a short term high value, eg of a pollutant concentration.

Internal Combustion Engine
An engine in which a fuel/air mixture is burned within a chamber and the resulting pressure of hot gas is converted to mechanical energy. In contrast external combustion, as in a boiler furnace, involves the transmission of energy by a separate agent, eg via a steam cycle.

Intermittent—sampling
In contrast to continuous sampling (q.v.) intermittent sampling means that sampling occurs at intervals for only a fraction of the total time.

Interpolate
To estimate the value of something between actual measured values, eg estimating pollution levels at points between sites at which pollution measurements are actually made.

Inversion
In meteorology an inversion exists where the normal temperature gradient in the atmosphere (decreasing temperature with height) is inverted at some height. In the space below this, pollutant emissions may be trapped and accumulate.

In Vitro/In Vivo
These two terms differentiate the experimental reproduction of biological processes in isolation from the living organism—in vitro—and biological processes occurring within the living organism—in vivo.

Ion
An electrically charged atom, radical or molecule.

Isokinetic
Literally equal moving. Isokinetic sampling implies sampling at such a rate that the motion of the gas entering the sampling nozzle is the same as that of the gas being sampled. The sample can thus be expected to have the same particulate content as the gas being sampled.

Isopleth
A line drawn on a map linking places with the same value of some parameter, eg height, annual rainfall, pollutant concentration etc; a sort of contour line.

Isothermal
Literally at constant temperature. An isothermal layer in the atmosphere is one in which there is not temperature variation with height above the ground.

ISO
International Standards Organisation.

Isotope
Many elements exist in a number of forms of different atomic weight: isotopes. While they have similar chemical properties their physical properties differ. The most dramatic type of possible physical difference is probably radioactivity.

Joule (J)
The SI unit of energy, the capacity for doing work. 1 Joule=10^7 ergs. There are several different common forms of energy, eg thermal, electrical, chemical etc. 1 calorie (cal)=4·1868 J and 1 Btu is approximately 1055 J.

Katabatic Wind
The local flow downhill of cold air, usually occurring on clear nights.

Kelvin (K)
The SI unit of temperature interval. The Kelvin or absolute scale of temperature starts from absolute zero temperature.
1 Kelvin=1 Celsius degree=1·8Fahrenheit degree.
273·15 K=0°C=32°F

Kerosine
A liquid petroleum distillate (paraffin) used for lamps and heating appliances. Kerosine is also used in industrial gas turbines and jet engines.

Kilogram (kg)
The SI unit of mass. 1 lb is approximately 0·4536 kg.

Knock
The situation in a spark ignition internal combustion engine where part of the air/fuel mixture detonates on compression before the flame front has reached it. The tendency of a fuel to knock in a petrol engine can be reduced by the blending of suitable components in the fuel or by antiknock additives (q.v.).

Labile
A labile material is one which is unstable or reactive.

Lachrymatory (Lacrimatory or Lacrymatory)
Causing tears. Certain substances cause tear production when they come in contact with the eyes, eg PAN (q.v.).

Land Breeze
See Sea Breeze.

Lapse Rate
In meteorology, this term is used to denote the rate of decrease of a quantity with height. Temperature is usually implied. Usually temperature decreases with height, ie there is a lapse rate. One speaks of a negative lapse rate if temperature increases with height.

Laser
A system of producing a very narrow light beam (monochromatic and in-phase) which does not diverge and can be transmitted long distances and aimed accurately. Laser radar or LIDAR (q.v.) is used in air pollution studies.

Lead (Pb)
A metallic element. Lead and its compounds can be retained in the human body with clinical and subclinical effects. In contrast to other air pollutants lead is one where the bulk of human intake comes not from the air but from food and drink. Lead in the air arises most generally from antiknock additives to petrol. Lead industries can contribute to local aerial and land contamination.

Lead Dioxide Candle
A device in which sulphur dioxide in the air reacts with a film of lead dioxide to produce lead sulphate which is subsequently measured. The device thus

gives an indication of sulphur dioxide in the air but its performance is influenced by conditions such as wind and humidity.
There is a British Standard instrument, BS 1747: Part 4, which is obsolescent.

Lean—mixture
The air/fuel mixture is an internal combustion engine is described as lean if it contains a low proportion of fuel. At the other end of the scale a mixture with a high proportion of fuel is described as rich.

LIDAR
Laser-radar which can be used to study the position and concentration of pollutants both particulate and gaseous by the reflection or absorption of a laser beam.

LNG
Liquefied Natural Gas.

LPG
Liquefied Petroleum Gas.

Lung Function
Literally the function of the lungs namely the transfer of oxygen from the air to the blood and the disposal to the air of carbon dioxide from the blood. More specifically it is a measure of long performance.

MAC
Maximum allowable concentration. An American term akin to the TLV (q.v.).

Mean—algebraic—arithmetic—geometric
Generally similar to the idea of an average. The arithmetic mean, or the average, of a set of values is their sum divided by their number. The algebraic mean takes account of whether the numbers are positive or negative. The geometric mean is the nth root of the product of n values.

Means—best practicable
According to the Alkali Act a scheduled process must be provided with the *best practicable means* for preventing the escape of noxious or offensive gases and smoke, grit and dust to the atmosphere and for rendering such gases, where necessarily discharged, harmless and inoffensive. The worlds best practicable means are often used to describe the whole approach of British anti-pollution legislation towards industrial emissions which takes account of the cost of pollution abatement and its effect on the viability of industry.

Median
The middle value in terms of magnitude in a series of values. If the number of values is even then the median is the mean of the two middle values.

Mercaptan
Organic compounds with the general formula R-S-H.

Mercury (Hg)
A dense metallic element, liquid at normal temperatures. It is for instance used in thermometers. It has wide industrial uses. The metal in vapour form and its compounds are extremely poisonous but normal ambient concentrations are not regarded as harmful.

Meteorological
This is the adjective derived from meteorology which is the study of the physical phenomenon of the earth's atmosphere in relation to weather and climate.

Meter
Sometimes an alternative spelling for metre (q.v.).
Usually a machine or instrument for measuring something eg a gas meter.

Metre (m)
This is the basic international (SI) unit of length and from it are derived the units of area, the square metre (m^2) and of volume the cubic metre (m^3). 1m=39·37 inches. $1m^2$ is approximately 10·76 ft^2 and $1m^3$ is approximately 35·31 ft^3.

Microclimate
The distinctive pattern of meteorological variables within the lowest layers of the atmosphere or (sometimes) within a limited area (eg a town).

Microgram (μg)
A microgram is a millionth (10^{-6}) of a gram (q.v.) and is a unit of mass.

Micrometeorology
Detailed study of physical phenomena in the very lowest layers of the atmosphere or occasionally over a restricted area (eg a town).

Micrometre (μm)
This is a unit of length, one millionth (10^{-6}) of a metre. It is still commonly referred to as a micron.

Millibar (mbar)
A unit of pressure, one thousandth of the basic SI unit, the bar (q.v.). The millibar is equal to 100 $Newtons/m^2$ or 10^3 $dynes/cm^2$ and approximately 0·75mm of mercury.

Mist
A suspension or dispersion of liquid droplets in a gas. Usually applied to water droplets in air where visibility has a value of 1 km or more. Natural mists may be aggravated by air pollutants. See Haze and Fog.

Mixing Height
The height in the atmosphere within which emitted pollutants are dispersed and mixed. Often the height of the bottom of an inversion layer (q.v.).

Model (Mathematical/Physical)
1) An air pollution mathematical model is a numerical simulation of the emission, dispersion and chemical processes controlling ambient pollutant concentrations.
2) A physical simulation (eg in a wind tunnel) of the emission and dispersion processes controlling ambient pollutant concentrations in a physical model.

Mole
The amount of a substance of a certain formula that contains the same number of formula units (atoms or molecules etc) as 12g. of carbon of atomic weight 12. It is thus the formula weight in grams and used to be called the gram molecule.

Monitoring
Generally this is used interchangeably with surveillance (q.v.) to mean measuring air pollution continuously or regularly. More specifically it may imply checking that the level of an air pollutant is within prescribed limits.

Nanogram (ng)
A unit of mass equal to one thousandth of one millionth of a gram (10^{-9}g).

Natural Gas
In contrast to coal gas or town's gas which are manufactured by distillation or chemical reaction, natural gas comes from the tapping of natural hydrocarbon deposits. It does not contain carbon monoxide.

Necrosis
Fatal damage to cell tissue.

Nephelometer
An instrument for measuring the amount of light scattered or absorbed by a suspension of particles. It is used to determine suspended particle concentrations or particle size.

Neutral—solution—atmosphere
Neither one side nor the other, indeterminate. Thus a neutral solution is neither acid nor alkaline.
A neutral atmosphere is one in which there is no change in potential temperature with height.

Newton (N)
The SI unit of force. A force of 1 Newton applied to a mass of 1 kg will produce an acceleration of 1 metre per second per second. It is equal to 105 dynes or approximately 0·223 lb force or 0·102 kg force.

Nitric Acid (HNO_3)
A fuming unstable acid liquid. It is used industrially in the production of fertilisers, explosives etc. It can be formed as an aerosol in the atmosphere by the oxidation of oxides of nitrogen plus water.

Nitric Oxide (NO)
A colourless gas, toxic at sufficiently high concentrations. High temperature combustion tends to fix or combine atmospheric nitrogen as nitric oxide. It is involved in the photochemical reactions with certain hydrocarbons producing oxidants.

Nitrogen Dioxide (NO_2)
A stable brown gas, toxic in sufficiently high concentrations. It is formed by the aerial oxidation of nitric oxide (q.v.).

Nomogram
A form of chart containing scales for the variables (usually 3) involved in a particular formula or calculation. For any values of two of the variables the corresponding value of the third lies in a straight line with the values of the other two.

NOX
This is a shorthand way of referring to all the oxides of nitrogen, but usually to nitric oxide (NO) and nitrogen dioxide (NO_2) in matters of air pollution. Nitrous oxide (N_2O), the anaesthetic laughing gas, is a third reasonably stable oxide of nitrogen.

Noxious
Harmful.

N.T.P.
Normal Temperature and Pressure.
A temperature of 0°C and a pressure of 760mm mercury. Information on gas volumes etc can often be more easily compared when expressed at these 'standard' conditions of temperature and pressure.

Nuclear Power
See Atomic Power.

Obscuration
Concealing from sight. In meteorology it relates to restriction of visibility.

Octane Rating
An indicator of the tendency of a motor gasoline to knock (q.v.) in a spark ignition internal combustion engine, higher octane ratings being required for engines of higher compression ratios. The octane number is the percentage by volume of the hydrocarbon iso-octane in a mixture with normal heptane which has the same knocking characteristics as the fuel under test. The higher the octane number the lower the tendency to knock.

Odour Threshold
The concentration of an odour-bearing gas at which only half of a panel of sniffers can detect the smell.

Olefins
Hydrocarbons of the ethylene series of the general formula C_nH_{2n}. They have a double bond between two carbon atoms which makes them very reactive. It is reactive hydrocarbons of this sort which take part in photochemical smog reactions.

On-line
1) A method of measuring a variable in a process continuously and rapidly as the process operates is described as on-line.
2) The arrangement of a computer to process input data without delay and present an output result, say to control a plant, is described as on-line operation.

Organoleptic
Affecting a sensory organ. Thus organoleptic methods of estimating odour depend upon their perception by the human nose.

Orographic Rain
Rain caused by the rising and cooling of moist air as it passes over mountains.

Oxidants
Materials which have an oxidising action on other materials i.e. generally adding oxygen to them chemically or extracting hydrogen.
Typical atmospheric oxidants are ozone and nitrogen dioxide whose action on vegetable material can be damaging.

Oxides of Nitrogen
See NOX.

Oxygen (O)
The normal molecular form of oxygen (O_2) is the most essential constituent of the air for all life. 21% by volume of the air at ground level consists of oxygen. Oxygen is consumed when all fuels are burned.

Ozone (O_3)
This is a reactive molecular form of oxygen (q.v.) which is harmful in sufficient concentrations, particularly to plants. The atmosphere has a natural ozone gas content but further quantities arise from the photochemical reactions of hydrocarbons and oxides of nitrogen produced particularly by combustion.

PAN
Peroxyacetyl nitrate. This is the eye-irritant compound associated with the Los Angeles type photochemical smog.

Particle Size Distribution
A way of expressing the make up of a population of particles in terms of either the weight or number of particles between certain size limits, eg diameters of 0-1 μm, 1-5 μm, 5-10 μm etc. There are instruments for separating particles into these fractions.

Particulates
Particulate matter in the air usually refers to small solid particles of material found in the atmosphere in addition to gases. Less frequently applied to small liquid aerosol particles.

Pathogenic
Capable of producing disease.

Petri Dish
A shallow circular glass, or plastic, dish used for bacterial cultures.

pH
A unit by which the acidity or alkalinity of a liquid is described. Water, which is described as neutral, has a pH of 7. A lower pH signifies greater acidity than water and a higher pH greater alkalinity. pH is in fact the negative logarithm of the hydrogen activity (usually similar to concentration).

Photochemistry/Photochemical
Photochemistry deals with the chemical effects of radiation, chiefly visible and ultra-violet, and also the production of radiation by chemical changes.
Sunlight can produce chemical reactions between certain atmospheric pollutants, notably oxides of nitrogen and reactive hydrocarbons. These reactions are involved in the formation of photochemical smog.

Phytotoxic
Poisonous to plants.

Plume
The flow of effluent (usually visible effluent) from a specific outlet such as a chimney stack or vent.

Pneumoconiosis or Pneumonoconiosis
A term applied to various diseases of the lung caused by the inhalation of dust particles in such occupations as coal mining, quarrying and asbestos working; an excess of fibrous tissue forms in the lungs round the dust particles.

Pollen
The small grains from the anthers of flowers which contain the male reproductive nuclei. Transported in the air certain of these grains in the air can induce hay fever or asthma in some people by action in the nose. They are thus natural air pollutants.

Pollutant (Primary & Secondary)
A pollutant is something which pollutes the air (see pollution). A primary air pollutant is one which is put into the air in that form. A secondary pollutant is not emitted as such but forms in the air from primary materials.

Pollution
There are many different views as to what constitutes pollution. To some, pollution implies the increase, or even decrease, of any environmental constituent from the value it would have without human activity. A more useful definition is that pollution is significant if an environmental constituent is present to the extent that there is a significant hazard to present or future health or to the natural systems upon which man depends. Pollution may also be significant if it has a serious effect upon amenity (q.v.).

Polycyclics
Organic compounds with molecules containing a number of rings of carbon atoms. Certain polycyclic hydrocarbons which can arise from combustion are carcinogenic, ie capable of causing cancer. Sometimes polycyclics are called polynuclears.

ppb (European)
A billion in European usage is a million times a million (10^{12}) so ppb is parts per million million. Cf. ppb (U.S.).

ppb (US)
In America a billion is used to mean a thousand million as against a million million in Europe. Thus 1 ppb (US) = 1000 ppb (European).

pphm
Parts per hundred million.

ppm
Parts per million. In pollution of the air by a gaseous pollutant it refers to the number of parts by volume of the gaseous pollutant in one million parts of the total air. Concentrations of various gases expressed in ppm are proportional to their molecular concentrations.

Precipitation
1) The formation of a solid from solution.
2) A process of separation of particles from a fluid. In meteorological parlance, moisture falling on the earth's surface as rain, hail or snow or even dew.

Precision
The extent to which repeated measurements conform to themselves; in contrast to accuracy which is how close the measurements are to the true values.

Precursor
Something which goes before. Commonly applied to substances in the air which subsequently react or are transformed to produce new air pollutants, eg hydrocarbons are precursors of ozone and other compounds associated with photochemical smog.

Primary Air
The air supplied to a fuel in its early stages of combustion.

Quartile
If a ranked series of values is divided into four equal parts, eg twenty values into four sets of five in order of magnitude, each set is called a quartile. The upper quartile is that set below which lie three quarters of the ranked series of values; the lower quartile is that set above which lie three quarters of the ranked series of values.

Radiation Fog
With a clear sky and light wind there can be substantial cooling of the air during the evening and night. Where the air temperature falls below the dew point (q.v.) a radiation fog can be formed.

Radiosonde
A balloon-borne instrument which transmits measurements of pressure, temperature etc as it rises and moves with the wind.

Rainout
Cf. washout. The mechanism whereby small particles in the air are removed by being accumulated in raindrops as they form.

Random error/sampling
Random error see error.
Random sampling or selection can be used loosely to describe a sampling regime without a predetermined pattern, eg just any time. Proper random sampling involves the express selection of sampling units or times so that there is no bias towards selection of particular units or times and the sample is as likely as possible to be representative of the whole.

Reference Method
A reference method of analysis is one against which others are compared. Usually it is a method of high accuracy and precision (q.v.) and need not be so simple to perform as a routine method.

Reflectance
The reflectance of a surface is a measure of the extent to which the surface will reflect light or other radiation.
Reduction in the reflectance of filter paper as it is soiled by smoke is the basis of the UK smoke stain method of measuring atmospheric smoke concentrations.

Relative Humidity
See Humidity.

Recycling
In respect of wastes such as paper etc recycling implies the reuse of the material generally to make the same sort of product. In some cases reuse for another purpose is included in the term recycling in that it is assisting material conservation. Exhaust gases from motor vehicles may be recycled in the air input to reduce the overall production of air pollutants.

Reproducibility
The extent to which an experiment or measurement performed under the same conditions will give the same results.

Residual Oils
The oils which are left over as unvaporised liquid from normal crude oil distillation. They usually contain more sulphur than the lighter oils, are denser, more viscous and may produce significant amounts of ash on combustion.

Response
Reaction or effect of something to a stimulus or influence, eg the effect of a pollutant concentration upon a living organism.

Rich (mixture)
See Lean.

Ringelmann
The British Standard Ringelmann smoke chart (BS 2742) is for assessing the darkness of a plume of smoke by visual comparison with a numbered set of grids differing from each other in the width and spacing of black lines printed on a white background. Thus Ringelmann 1 is equivalent to 20% black
2 ,, ,, ,, 40% ,,
3 ,, ,, ,, 60% ,,
4 ,, ,, ,, 80% ,,
5 ,, ,, ,, 100% ,,
"Dark smoke" is smoke which is as dark or darker than Ringelmann 2 and "black smoke" is as dark or darker than Ringelmann 4.

Sampling
The action of taking or withdrawing a fraction of something usually for study as representative of the whole. Proper sampling is most important in air pollution work.

Sampling Error
See Error.

Saturation
The point where a substance is charged with the greatest possible amount of another substance or property. In air pollution work it is most frequently used in respect of air being saturated with moisture in which case that air put in contact with a plane water surface at that temperature will neither gain nor lose water vapour.

Scrubbing
An absorption operation in which gaseous or fine particulate pollutants are removed from a stream of air or gas by contact with a liquid—a spray or a bath or wetted packing in a tower.

Sea Breeze
A local wind blowing on shore when and because the land surface is warmer than the sea surface, eg on a sunny day. The situation may be reversed at night, producing an off-shore land breeze.

Sea Fret
A local name for fog produced in on-shore winds in certain conditions. It normally does not persist very far inland. Another name is "haar". Dispersion is poor in haars hence, if they occur in regions where pollution is emitted, high pollutant concentrations may result. The haar may be made more persistent by pollutants.

Secondary Air
Air introduced above or beyond the bed of burning fuel to promote the complete combustion of volatile material produced in the first stage of combustion (see also Primary Air).

Sensitivity
In chemical analysis the sensitivity of a method is a measure of the minimum increment of the item of interest which can be estimated by the method. It is also used to describe an abnormal reaction of the body to certain substances (see Allergy).

Settling Velocity
See Terminal Settling Velocity.

Shear
See Wind Shear.

Significance
A statistical term used in assessing whether the difference between an observation (result) and some standard of comparison is real and not attributable to observational error etc.

SI Units
Units of measurement in the Systeme International. This system, having wide international acceptance by standards institutions, provides units for such basic physical quantities as length (metre), mass (kilogram), energy (Joule) temperature (Kelvin), angle (radian) and time (second). From these a number of other units are derived.

Smog
The word derives from the combination of smoke and fog and thus succinctly describes the smoky fogs which London used to experience. It was, in fact, coined by Dr Des Voeux, the founder President of the National Smoke Abatement Society. Photochemical smog is the term applied to the phenomenon found in Los Angeles and certain other heavily motorised cities where reactions, particularly between oxides of nitrogen and hydrocarbons, under the influence of sunlight can produce poor visibility, a brown pall in the air, eye irritation and damage to materials and vegetation.

Smoke
This has a number of meanings including:
1) Small gas-borne liquid and/or solid particles formed by incomplete combustion of fuel and in the size range 0·001 to 1·0 μg.
2) In the Clean Air Act "smoke" is taken to include soot, ash, grit and gritty particles emitted in smoke.
3) Suspended matter collected on filter paper in accordance with BS 1747: Part 2.

Smoke Control Area
This describes an area which has been designated by a Local Authority as one in which only Authorised Fuels (q.v.) may be burned in accordance with the Clean Air Act.

Smoke Stain
This term is applied to the darkness of a filter through which air has been sampled. The filter retains smoke particles and the stain can be expressed as a concentration of equivalent standard smoke (q.v.).

Smuts
Small aggregates of soot, unburnt solids or fly ash which may be emitted from chimneys and then be deposited in the vicinity. In certain circumstances the production of sulphur trioxide during combustion can give rise to acid smuts which are corrosive.

Snap-sample
See Grab-sample.

Soiling (index)
The soiling or dirtying of a filter paper through which air has been sampled can be used as a measure of the smoke content of the air.
See also smoke stain and COH.

Soot
Aggregates of carbonaceous particles impregnated with tar formed by the incomplete combustion of carbonaceous material, particularly bituminous coal. They tend to adhere to the inside of the chimney etc.

Spark Ignition
The principle of fuel ignition in the normal petrol internal combustion engine where the compressed fuel/air mixture is ignited by an electric spark.

Specific Gravity
The specific gravity or relative density of something is its density (q.v.) relative to that of water under specified conditions.

Spectrophotometry
The measurement of the concentration of something by the amount of light emitted or absorbed of a colour (wavelength) characteristic of the thing being measured.

Stable (Compound/Atmosphere)
1) A stable compound is one which is not readily decomposed or not very reactive.
2) In describing the atmosphere it is frequently used to mean a state in which vertical air movement is restricted. An inversion may produce a stable layer.

Stack Solids
The solid content of the gas stream going up a stack or chimney.

Stagnation/Stagnant
A situation in which there is no flow. Air can stagnate in valleys trapped by an inversion. (q.v.).

Standard
Broadly a unit used as a basis of comparison but in respect of air quality it can have a number of different meanings. It can imply a commonly agreed level above which effects of some type or other are believed to occur. It can also represent an air quality or emission level which the regulations say must not be exceeded (either at all or for specified periods). The maximum permitted level of air contaminant as established by a legal authority. A British Standard refers to a standard specification from the B.S.I. (q.v.).

Standard Deviation
A widely used measure of the dispersion of a number of observations of some quantity. It is the square root of the average of the squares of the differences of each observation from the mean of those observations.

Standard Smoke
For certain smokes the relationship has been measured between the darkness of stains produced by sampling on a filter and separate gravimetric measurements of the smoke concentrations. This allows filter stains to be expressed in terms of a concentration of equivalent standard smoke.

Stoichiometric
The exact or fixed proportions of elements in a chemical compound or of reactants to produce a compound. Thus in common salt ($NaCl$) the stoichiometric ratio of sodium atoms to chlorine atoms is 1:1.

Stokes
Stokes systematised the subject of viscosity promulgating Stokes Law relating the factors controlling the movement of a spherical particle through a fluid. The Stokes diameter of a particle is the diameter of a sphere which would move in a fluid in a similar

fashion to the particle in question which may not be spherical.

Stomata
The small apertures or pores in a leaf epidermis (skin) or a young stem. They allow the passage of gases and vapours into and out of leaves. It can be damaging to a plant if the stomata are blocked, eg by fine dust or fungi.

S.T.P.
Standard Temperature and Pressure. Usually the same as NTP (q.v.) but sometimes referring to other conditions, eg 60°F and 30 inches of mercury.

Stratosphere
The earth's atmosphere above the tropopause (q.v.), some 8 to 80 km in depth. Its temperature does not vary with height and it contains little moisture.

Sulphate
Salts of sulphuric acid containing the SO_4 group of atoms. Sulphur dioxide emitted from the burning of sulphur in fuels is oxidised slowly in the atmosphere to sulphur trioxide which forms sulphuric acid with moisture and sulphates with basic materials such as ammonia or metals and their oxides. Sulphates so formed are particulates. Sea spray is a substantial natural source of airborne sulphate particles.

Sulphur Dioxide (SO_2)
This is the main product of the combustion of sulphur contained in fuels. Globally, much of the sulphur dioxide in the atmosphere comes from natural sources, but in highly developed and heavily populated regions the greater part of sulphur dioxide concentrations comes from fossil fuel combustion.

Sulphuric Acid (H_2SO_4)
Sulphur dioxide oxidises in the air to sulphur trioxide SO_3 which forms sulphuric acid with moisture. It is a corrosive acid.

Survey—surveillance
An air pollution survey is an examination of the condition of the air usually at a number of points. Surveillance implies surveying over time—keeping an eye on things.
Monitoring (q.v.) is often used in the same sense.

Synoptic
Affording an overall view. In meteorology, a synoptic chart displays the state of the atmosphere over a large area at one time. By extension, synoptic is used to refer to features, eg cyclones or anticyclones, which appear in such charts.

Suspended Particulates
A term describing particles which are too small to have an appreciable falling velocity and therefore tend to stay suspended in the atmosphere for a considerable period. By and large they are of 5 μm diameter or less.

Symbiosis/Symbiotic
Symbiosis (of which symbiotic is the adjective) is a phenomenon where there is a mutually beneficial relationship between two organisms or factors.

Synergism/Synergistic
The phenomenon in which the effect of two things together is greater than the sum of the effects of the things separately. The adjective is synergistic.

Tar
A thick, dark brown or black viscous liquid obtained by distilling of wood, coal, peat, crude oil etc.
The distillation need not be in a still. Some distillation can occur in the domestic grate and chimney.

Target
1) An objective. A certain air quality may be a desirable target to aim at.
2) In assessing pollution effects the word target is frequently used to describe things actually hit or affected by pollutants.

TEL
Tetra ethyl lead (TEL) and tetra methyl lead (TML) are the principal additives to petrol to raise the octane rating (q.v.) and thus reduce the tendency to knock (q.v.) in spark ignition internal combustion engines.

Telemetering
The transmission of signals from a measuring instrument by telephone line or radio to a distant point where the results can be displayed or recorded. Thus the levels of pollution at a number of locations can be displayed at a single point.

Terminal Settling Velocity
The maximum velocity reached by a falling particle when the gravitational force on it (its weight) is balanced by the viscous drag of the fluid through which it is falling.

T.L.C.
TLC, Threshold Limit Concentration = TLV (q.v.).

TLV
Threshold Limit Value. This is the concentration of any of a number of pollutants recommended as a maximum to which *healthy adult workers* may be exposed for eight hours a day five days a week without adverse effects. The list is compiled by the American Conference of Governmental Industrial Hygienists but is used extensively in many countries.
Although $^1/_{30}$ or $^1/_{40}$ of the TLV is often used as a rule of thumb guide to an acceptable ambient concentration of a pollutant for *the general public*, there are many exceptions and the ACGIH specifically warns against the practice.

Tonne
The metric ton equal to 1000 kg or 2204·6 lb whereas 1 ton equals 2240 lb.

Topography
The layout of an area in terms of height —the natural features and/or the buildings etc.

Toxicity
A measure of the poisonous or damaging effect of a substance on a living organism.

Tracer Technique
A method of studying pollutant behaviour in the air by the injection or release of a specifically identifiable substance. The subsequent distribution of the tracer is taken to be similar to that of the pollutant from the same starting point.

Tropopause
The boundary between the troposphere (q.v.) and the stratosphere (q.v.).

Troposphere
The lower part of the earth's atmosphere, some 9 to 20 km deep, in which the temperature generally decreases with height. It contains the air we breathe and in which weather processes occur.

Turbidity
1) The cloudiness of a liquid caused by fine suspended particles. More precisely it describes the reduction of light passing through the liquid (caused by the suspended particles).
2) In meteorology any condition of the atmosphere which reduces its transparency to light; a measure of the reduction of transparency — normally excluding cloud.

Turbulence
A motion of the wind in a highly irregular manner both in speed and direction. It is the main mechanism of diffusion of pollutants in the air.

Unstable
1) An unstable chemical compound is one which is easily decomposed or reacted with.
2) An unstable atmosphere is one in which turbulent motions tend to grow thereby substantially aiding the dispersion of pollution.

Vanadium
A metallic element some of whose compounds can be poisonous under

certain conditions. It occurs in coal and fuel oil in varying amounts and is contained in the ash or unburnt solids emitted from combustion of these fuels.

Vapour
A gas is said to be a vapour if, at the temperature concerned, it can be liquified by pressure alone.

Vapour Pressure
The pressure exerted by a vapour, either alone or mixed with other gases. The saturated vapour pressure of a substance at any temperature is pressure of the vapour of the substance in equilibrium with its liquid form.

Variance
A statistical term—the square of the standard deviation (q.v.) ie the average of the squares of the deviations of a number of observations of a quantity from their mean value.

VDI
Verein Deutscher Ingenieure, the Association of German Engineers, produces standards and recommendations (codes of practice) in a number of technical areas including air pollution control.

Ventilation
1) The process of replacing contaminated or stale air by fresh air.
2) The movement and circulation of outdoor air.
3) The volume of air entering or leaving the lungs in one respiratory cycle.

Venturi
The name Venturi is applied to a tube which is constricted and then opens out again and can be used:
1) to meter the flow of gas
2) to assist the scrubbing of a gas by a liquid.

Viscosity
The resistance of a fluid to shear forces and hence to flow. The viscosity of syrup is greater than that of water.

Visibility
A measure of clearness of the air expressing how far objects can be clearly seen under specified conditions. Light absorption and scattering by aerosols are the main causes of reduced visibility.

Warm Front
The sharp boundary between two extensive air masses where warm air is replacing cold air.

Washing (Gas washing)
See scrubbing.

Washout
The removal of gases, sometimes particles, from the atmosphere by their solution or attachment to rain drops as they fall (cf. rainout).

Windrose
A diagram showing the frequency and strength of winds of various directions over a period for a particular locality.

Wind Shear
The change in speed and direction of the wind, usually with height.

Zinc (Zn)
A metallic element some of whose compounds are poisonous, particularly to plants.

AN OUTLINE OF THE LAW RELATING TO AIR POLLUTION

The control of air pollution in Great Britain is essentially a team effort involving Local Authorities, the Department of the Environment, Police Authorities (in respect of road vehicle emissions) and the Health and Safety Executive (in respect of the work of the Factory Inspectorate and the Alkali and Clean Air Inspectorate).

The principal legislation enforced by local authorities in Great Britain (excluding Northern Ireland) is contained in the Clean Air Acts 1956 and 1968, but some of the "nuisance" provisions of the Public Health Act 1936, extended and amended by the Public Health Act 1961 and the Public Health (Recurring Nuisances) Act 1969, are applicable in specified circumstances. Part IV of the Control of Pollution Act 1974, when operative, will further extend and modify Clean Air legislation in several ways. The domestic smoke control area provisions of the Clean Air Act 1956 were amended by Section 95 of the Housing Act 1964 and further amended by the Clean Air Act 1968. The Health and Safety at Work Etc Act 1974 imposes a general duty on the person having control of a prescribed class of premises to use the best practicable means for preventing the emission into the atmosphere of noxious or offensive substances and for rendering harmless and inoffensive such substances as may be so emitted.

The provisions of the Clean Air (Northern Ireland) Act of 1964 are largely identical to those of the 1956 Act.

The control of "noxious or offensive gases" from some 60 different classes of works registrable under the provisions of the Alkali &c. Works Regulation Act 1906 and the associated Alkali &c. Works Order 1966 is exercised by the Alkali and Clean Air Inspectorate of the Health and Safety Executive (see the section on page 60 on the Alkali &c. Works Regulation Act).

Action may also be taken under Common Law procedure by anyone who suffers nuisance from air pollution, and in this way it may be possible to secure damages and/or to obtain an injunction.

There are also a number of Private Acts of Parliament in which some local authorities possess powers to deal with smoke emission, to establish smokeless zones and to grant optional prior approval of proposed new industrial fuel burning installations. Most of these provisions, although they may remain in force, have now been superseded by the provisions of the Clean Air Acts 1956 and 1968. The control of pollution from road vehicles is exercised by the police under the provisions of the Road Traffic Acts and the Motor Vehicles (Construction and Use) Regulations 1973, a note of which is to be found on a later page.

The following outline of current legislation, which necessarily omits much detail, gives the main provisions of the Clean Air Acts 1956 and 1968 and supporting Acts under the main subjects of "smoke", "chimney heights", "grit, dust and fume" and "miscellaneous provisions".

At the time of preparation of these notes, the Secretary of State for the Environment had announced his intention of bringing parts of the Control of Pollution Act 1974 into operation and it seems probable that the operative dates will be set for early 1976. The economic situation could, however, still prevent this and as a consequence, a full revision has not been attempted for the 1976 Year Book. Those sections of the current legislation referred to in this Section and likely to be modified or repealed by the Control of Pollution Act are marked with an asterisk (*) and the note "modified by CPA 1974".

Further information and details when available will be published in "Clean Air", the journal of the Society.

1. THE CONTROL OF SMOKE

A Definition of "dark" and "black" smoke:

Where legal standards of emission are prescribed for smoke, they refer to "dark" and "black" smoke. These are defined in the 1956 Act, and in Regulations, by reference to a shade on the British Standard Ringelmann Chart (see page 45) as:

"Dark" smoke (defined in S.34 of the 1956 Act) means smoke which if compared . . . with the Ringelmann Chart would appear to be as dark as or darker than shade 2 on the chart.

"Black" smoke (defined in the Dark Smoke (Permitted Periods) Regulations 1958; and in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 means smoke which, if compared . . . with the Ringelmann Chart, would appear to be as dark as or darker than shade 4 on the chart.

B Use of Aids in Assessing Smoke Colour:

Although legislation defines dark and black smoke by reference to colour shades on the Ringelmann Chart, the use of the Chart is not compulsory. S.34(2) of the 1956 Act says that "For the avoidance of doubt, it is hereby declared that . . . the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type."

C Design Standards for New Plant

Section 3 of the Clean Air Act 1956 requires all new furnaces (other than domestic boilers with a rating less than 55,000 Btu/hr.) to be, so far as practicable, capable of operating continuously without emitting smoke when burning fuel of a type for which the furnace was designed.

There is no definition of "furnace", but a practical interpretation of this word wherever it appears in Clean Air legislation, is usually taken as "any enclosed or partly enclosed space in which liquid, solid or gaseous matter is burned, or in which heat is produced".

It is a requirement of this section that the proposed installation of all new furnaces (other than domestic boilers rated at less than 55,000 Btu/hr.) *must* be notified to the local authority, and if one wishes to do so, one may apply for local authority approval that the proposed unit is capable of substantially smokeless operation. The approval does not, however, allow indiscriminate smoke emission and the furnace must be operated to ensure that permissible emissions are not exceeded.

D Standards for Smoke Emission:

Section one of the Clean Air Act 1956 prohibits the emission of dark smoke from a chimney, but also allows the Secretary of State for the Environment to make regulations exempting prescribed lengths of emission from possible action under this section.

The "permitted emissions" are prescribed in the Dark Smoke (Permitted Periods) Regulation 1958: and the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958.

D(1) The Dark Smoke (Permitted Periods) Regulations 1958 (Statutory Instrument 1958 No. 498)

(*a*) Aggregate emissions of dark smoke.

Number of furnaces served by the chimney	*Permitted emission of dark smoke in any period of eight hours*	
	If not soot blowing during period	*If soot blowing during period*
One	10 mins.	14 mins.
Two	18 mins.	25 mins.
Three	24 mins.	34 mins.
Four or more	29 mins.	41 mins.

Where a single boiler or unit of industrial plant is fired by more than one furnace discharging into the same chimney, those furnaces shall be deemed to be one furnace.

(*b*) Continuous emissions of dark smoke

The continuous emission of dark smoke in excess of four minutes, caused otherwise than by soot blowing, is prohibited.

(*c*) Aggregate emission of black smoke

No emission of black smoke exceeding two minutes aggregate in any period of thirty minutes is allowed.

There are thus three standards of emission which are acceptable in relation to any one chimney. The penalty for an offence under section one of the Act is a fine not exceeding £100 for each day on which the offence occurs.

D(2) The Dark Smoke (Permitted Periods) (Vessels) Regulations 1958 (Statutory Instrument 1958 No. 878)

By the provisions of section 20 of the 1956 Act, vessels in waters not navigable by sea-going ships and in certain waters within the seaward limits of the territorial waters of the United Kingdom, must comply with the dark smoke provisions of section one of the 1956 Act, subject to the permitted emissions contained in the Dark Smoke (Permitted Periods) (Vessels) Regulations 1958, as follows:—

Class of Case	*Permitted Period for Emission of Dark Smoke*
1. Emissions from a forced draught oil-fired boiler furnace, or an oil engine.	10 minutes in the aggregate in any period of 2 hours.
2. Emission from a natural draught oil-fired boiler furnace (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
3. Emissions from a coal-fired boiler furnace:—	
(*a*) when the vessel is not under way (except in the cases falling within class 4 below).	10 minutes in the aggregate in any period of one hour.
(*b*) when the vessel is under way.	20 minutes in the aggregate in any period of one hour.
4. Emissions from a natural draught oil-fired boiler furnace or a coal-fired boiler furnace in the following cases:—	
(*a*) a vessel with funnels shortened for the purpose of navigating the Manchester Ship Canal; (*b*) a tug not under way, but preparing to get under way or supplying power to other vessels or to shore installations; (*c*) a vessel not under way but using main power for the purpose of dredging, lifting, pumping or performing some other special operation for which the vessel is designed.	20 minutes in the aggregate in any period of one hour.
5. Emissions from any other source.	5 minutes in the aggregate in any period of 1 hour.

A vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground shall be deemed to be under way. The Regulations include a proviso that:

(*a*) **continuous emissions of dark smoke caused otherwise than by the soot blowing of a water tube boiler shall not exceed**

(i) in the case of classes 1 and 2, 4 minutes;

(ii) in the case of natural draught oil-fired boiler furnaces in class 4, 10 minutes; and

(iii) in no case shall black smoke be emitted for more than 3 minutes in the aggregate in any period of 30 minutes.

D(3) Defences for excessive dark and black smoke emission

Section one of the 1956 Act contains three defences which may be available if an occupier of premises is proceeded against for dark/black smoke emission. These briefly are that the emission was:—

(*a*) solely due to lighting a furnace from cold and all practicable steps had been taken to minimise emissions.

(*b*) solely due to unavoidable mechanical failure of part of the plant and the contravention could not have been prevented after failure occurred.

(*c*) solely due to the unavoidable use of unsuitable fuel, suitable fuel not being available and the best available fuel being used; and all practicable steps were taken to minimise the emission.

(*d*) due to any combination of (*a*), (*b*) and (*c*).

N.B. That these are not absolute defences and are available only if every practical effort is made to avoid and/or minimise emissions.

E Emissions of Dark Smoke from "Bonfires", etc.

On 1st October 1969 Section one of the Clean Air Act 1968 became operative. This section prohibits (subject to prescribed exemptions) the emission of dark smoke from industrial or trade premises (as distinct from chimneys) and is concerned mainly with preventing excessive smoke emission caused by the indiscriminate burning of industrial or trade refuse in the open, but this section will also control dark smoke emissions from industrial processes not having a chimney.

In this connection, "industrial or trade premises" means premises normally used for industrial or trade purposes, or premises not normally so used, but which, at the time of the offence, were being used for industrial or trade burning.

The Secretary of State has made the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969 which exempt the emission of dark smoke caused by the burning of the following materials, subject to the specified conditions:—

Exempted Matter

(1) *Matter*	(2) *Conditions*
1. Timber and any other waste matter (other than natural or synthetic rubber or flock or feathers) which results from the demolition of a building or clearance of a site in connection with any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961).	Conditions A, B and C.
2. Explosive (within the meaning of the Explosives Act 1875) which has become waste; and matter which has been contaminated by such explosive.	Conditions A and C.
3. Matter which is burnt in connection with (*a*) research into the cause or control of fire or (*b*) training in fire fighting.	Condition C.
4. Tar, pitch, asphalte and other matter which is burnt in connection with the preparation and laying of any surface, or which is burnt off any surface in connection with resurfacing, together with any fuel used for any such purpose.	Condition C.
5. Carcasses of animals or poultry which (*a*) have died, or are reasonably believed to have died, because of disease; (*b*) have been slaughtered because of disease; or (*c*) have been required to be slaughtered pursuant to the Diseases of Animals Act 1950.	Conditions A and C, unless the burning is carried out by or on behalf of an inspector (within the meaning of Section 84 of the Diseases of Animals Act 1950).
6. Containers which are contaminated by any pesticide or by any toxic substance used for veterinary or agricultural purposes; and in this paragraph "container" includes any sack, box, package or receptacle of any kind.	Conditions A, B and C.

The conditions referred to in column 2 are:—

CONDITION A That there is no other reasonably safe and practicable method of disposing of the matter.
CONDITION B That the burning is carried out in such a manner as to minimise the emission of dark smoke.
CONDITION C That the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on his behalf.

F Smoke Control Areas:

Sections 11 to 15 of the Clean Air Act 1956, Sections 8 to 10 of the 1968 Act and Section 95 of the Housing Act 1964 relate to Smoke Control Areas, the administrative procedures, and the enforcement of Smoke Control Orders.

Section 11 of the 1956 Act allows a Local Authority to make a Smoke Control Order which must be submitted to the Secretary of State of the Environment for confirmation. When operative it is an offence for an occupier of premises to allow smoke emission from a chimney, unless the smoke is caused by the use of an "authorised fuel"; or the "fireplace" which the chimney serves is exempt from the Order.

The Clean Air (Authorised Fuels) Regulations 1956, 1963, 1965, 1969, 1970 (No. 2), 1971, 1971 (No. 2), 1971 (No. 3) and 1971 (No. 4) allow the use of the following fuels in Smoke Control Areas, even though some may for short periods cause light smoke emission:—

Anthracite	
Low Volatile Steam Coal	
Phurnacite Ovoids	Manufactured solid smokeless fuels
Coalite, Rexco and Rexco Ovoids	
Gloco and Gas Coke	
Homefire and Roomheat	
Multiheat	
Sunbrite and 'hard' coke	
Cosiglow	
Maxiglow	
Fireglo briquettes	
Ancit briquettes	
Extracite ovoids	
Syntracite ovoids	
XL briquettes	
Anthracine ovoids	
Anthrite ovoids	
Gas and Electricity	

Other solidfuels are at various times submitted to the Department of the Environment for testing to determine whether or not they might become "Authorised Fuels" for use in Smoke Control Areas.

The Smoke Control Area (Exempted Fireplaces) Orders 1970, 1970 (No. 2) 1971, 1972, 1972 (No. 2) and 1975 (Nos. 2 and 3) conditionally exempt the emission of smoke from chimneys serving the following fireplaces:—

Class of Fireplace	*Conditions*
A. 1970 Order	
1. Any fireplace specially designed or adapted for combustion of liquid fuel.	
2. Any fireplace (other than a fireplace fired by pulverised fuel) constructed on or after 31st December 1956 and installed before 1st May 1970 and equipped with mechanical stokers, or adapted between those dates for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
3. Any fireplace designed to burn coal (other than a fireplace fired by pulverised coal) with a heating capacity exceeding 150,000 Btu/hr. constructed and installed on or after 31st December 1956 and equipped with mechanical stokers or adapted on or after that date for use with such stokers.	No fuel shall be used other than that for which the mechanical stoker was designed.
4. The fireplace known as the Solid Fuel Ductair Unit, manufactured by Radiation Limited.	
5. The fireplace known as the Fulgora Slow Combustion Stove, manufactured by Fulgora Stoves Limited.	No fuel shall be used other than wood waste in clean condition.
6. The fireplace known as the Housewarmer manufactured for the National Coal Board by Ideal Standard Limited	No fuel shall be used other than selected washed coal marketed under the name "Housewarm" by agreement with the National Coal Board.
7. The fireplace known as the Wood Chip Fired Air Heater, manufactured by Air Plants Ltd.	No fuel shall be used other than clean wood waste of a size within the limits referred to in the manufacturer's instructions.
8. The fireplace known as the Hounsell Sawdust Burning Stove, manufactured by John Hounsell (Engineers) Ltd.	No fuel shall be used other than wood waste in clean condition.
B. 1970 (No. 2) Order (S.I. 1970 No. 1667). The fireplace known as the Triancomatic T.80	No fuel shall be used other than selected washed coal marketed under the name "Housewarm" by agreement with the National Coal Board.
C. 1971 Order (S.I. 1971 No. 1265) The fireplace known as the Rayburn CB34.	
D. 1972 Order (S.I. 1972 No. 438). The fireplace known as the Parkray Coalmaster.	
E. 1972 (No. 2) Order (S.I. 1972 No. 955) The fireplace known as the Trianco TGB 17.	
F. 1973 Order (S.I. 1973 No. 2166) The fireplace known as the Rayburn Prince 101. The fireplace known as the Rayburn Prince 301.	
G. 1975 (No. 2) Order (S.I. 1975 No. 1001). The fireplace known as the Riley Nihot Woodchip Fired Air Heater type NMO11 manufactured by Clarke Chapman Limited International Combustion Division—Riley Unit.	No fuel shall be used other than clean wood waste of a size within the limits of the manufacturers specifications and containing not more than 5% sander dust.
H. 1975 (No. 3) Order (S.I. 1975 No. 1111). The fireplace known as the Rayburn Prince 76.	No fuel shall be used other than selected washed coal doubles and trebles.

In addition to the conditions above two standard conditions require all appliances to be installed, maintained and operated

(i) so as to minimise the emission of smoke;

(ii) in accordance with the manufacturer's instructions.

The local authority may also include in the Smoke Control Order other exemptions, which they may feel are necessary, subject to reasonable conditions. One of these is to allow the lighting of domestic fires with sticks and paper if there is no gas in the dwelling.

Thus, coal, oil and waste wood may not normally be burnt either by a householder or an industrialist unless on an exempted appliance, the design of which has satisfied the Secretary of State that it is capable of being operated substantially smokelessly and is exempted by Statutory Instrument.

The 1968 Act extended the Smoke Control provisions of the 1956 Act. The Minister is now empowered to require a local authority to make Smoke Control Orders. It is also an offence to acquire or to sell by retail for delivery in a Smoke Control Area any fuel other than an authorised fuel, unless in each case the premises or fireplace are exempt.

The financial provisions of the 1956 Act require the local authority to pay to owners or occupiers of dwelling houses a grant of 7/10ths of the reasonable cost of fireplace adaptations, and they may repay all or any part of the remaining 3/10ths. The local authority recovers 4/7ths of the grant from the Exchequer. A grant is not available in respect of a "new dwelling" begun on or after 16th August 1964.

The Housing Act 1964 allows a local authority to "designate" as unsuitable any appliances for which suitable fuels are not fully available, and in those circumstances a grant is not available for installation of those appliances.

Section 10 of the 1968 Act prevents a local authority from postponing the operation of a Smoke Control Order by more than 12 months.

Grant Arrangements

The principles which local authorities must follow in assessing eligibility of works of adaptation for grant are contained in the Memorandum on Smoke Control Areas revised by the Department of the Environment Circular 51/65. In Circular 32/71 the Department set cost limits for local authority guidance in assessing "reasonable costs":—

Smoke Control Area Grants: Cost Limits for Various Appliances (Circular 31/75) (under revision by DOE 1975)

	Cost Limit Excl. of VAT £
Improved open fire (including integral gas ignition and where necessary deepening plate and bar)	17
Improved open fire (including integral gas ignition and where necessary deepening plate and bar) with boiler	38 (a)
Underfloor draught fire and fan-assisted open fire	29
Underfloor draught fire and fan-assisted open fire with boiler	50 (a)
Solid fuel room heater	67
Solid fuel room heater with boiler	76 (a)
Gas room heater	34
Direct acting electric space heater	25
Electrical thermal storage heater	46
Oil room heater	36
Solid fuel cooker with boiler	187
Gas or electric cooker	72
Independent solid fuel boiler, **including installation**	55 (b)
Gas water heater (eg gas circulator and back boiler unit), **including installation**	55 (b)
Electric immersion water heater, **including installation**	33
Gas or electric wash boiler	30
Gas poker, including flex and tap	5
Bottled gas igniter	14
Provision of ignition appliances, **including installation**, per dwelling (not per fireplace)	20
Alternative source of heat in certain kitchens, **including installation**	20

NOTES: (a) Up to £12 may be added where
- (i) it would be impossible or inadvisable to connect the existing boiler to the new space-heating appliances, and
- (ii) either *a.* the existing boiler is itself bower-barffed or made of stainless steel, copper, aluminium, bronze or other superior material,
  or *b.* one of the above types is necessary to comply with local water bye-laws.

(b) Notional figure. Because the costs of this type of appliance exceed what is considered reasonably necessary, having regard to the cost of installing an electric immersion water heater, this cost limit has been determined on a notional basis. In assessing grant, VAT based on the cost limit should be added.

It is for the local authority to decide, within the appropriate level, what costs are reasonable in each case. In general the Department of the Environment will not accept as eligible for grant any expenditure which exceeds the stated limit.

G Statutory Procedure in the Event of an Offence for Excessive Smoke Emission* (modified by CPA 1974)

Section 30 of the 1956 Act requires the local authority authorised officer (usually the Environmental Health Officer) to notify "as soon as may be" the occupier of the premises of the offence and to confirm his notification in writing within 48 hours of becoming aware of the offence. (Modified by CPA 1974.)

This requirement applies to a contravention of Section one and eleven of the 1956 Act, i.e. Dark/Black smoke emission, and smoke emission in a smoke control area, and to Section one of the 1968 Act, i.e. dark smoke emission from industrial or trade burning. In any subsequent proceedings it is a defence to prove that the notification was not made "as soon as may be" or that the notification was not confirmed within two days following the date of offence.

H Statutory Smoke Nuisance:

Part III of the Public Health Act 1936 defines certain statutory nuisances, and prescribes the legal procedure for enforcing their abatement.

Section 16 of the Clean Air Act 1956 extends the provisions of Part III of the Public Health Act 1936, to include smoke nuisance, but a smoke nuisance cannot include:—

(i) smoke emitted from a chimney of a private dwelling, or
(ii) dark smoke from a chimney of a building or boiler or other plant (controlled by Section 1 of the 1956 Act), or
(iii) dark smoke caused by industrial or trade burning (controlled by Section 1 of the 1968 Act).

Where a smoke nuisance exists, the local authority may pursue the lengthy and cumbersome nuisance procedure, but if they are satisfied that the nuisance has occurred, has temporarily ceased, but is likely to recur, they may, without serving an Abatement Notice, cause a complaint to be made to the Magistrate's Court for the making of a Nuisance Order, following which the provisions of Part III of the Public Health Act 1936 for enforcement of the Order will apply.

Summary of the provisions relating to smoke emission

1. New plant must be capable of substantially smokeless operation.
2. The proposed installation of new furnaces must be notified to the local authority.
3. There are permitted periods for dark and black smoke emission from chimneys, and these standards apply throughout England and Wales.
4. The Permitted Periods Regulations apply whether or not premises are subject to a Smoke Control Order, but additionally, if in a Smoke Control Area, the occupier must ensure that smoke emission is prevented, or, where plant or premises are conditionally exempted, he must ensure that smoke emission is minimised.
5. A grant of 7/10ths of reasonable expenditure is available for the adaptation or replacement of domestic coal burning and similar open fires in a Smoke Control Area.
6. Dark smoke emission from bonfires, etc., on industrial or trade premises is, subject to exemptions, prohibited.
7. The authorised officer must notify the occupier of premises as soon as may be of the existence of an offence, and must confirm his notification in writing within 48 hours.
8. Smoke, other than smoke emitted from a dwelling, dark smoke from a chimney or dark smoke from industrial or trade burning, may if it causes a nuisance be regarded as a Statutory Nuisance under the Public Health Acts.

2. THE CONTROL OF CHIMNEY HEIGHTS

At whatever height smoke and flue gases are discharged, gravity will eventually bring the larger particles of grit, dust and soot to the ground. Additionally, because of the natural turbulence of the atmosphere, a proportion of the gases and of the freely suspended fine particles will reach the ground although not affected by gravity. The higher the point of discharge and the greater the total heat content of the discharge gases, the more widespread and diluted will be the fine particles and gases by the time they reach ground level.

The Legal Control of Chimney Heights

The legal control of chimney heights enables the local authority to take into account a number of relevant factors in determining the height of a chimney to avoid down draught or down wash created by the chimney itself, by buildings or topographical features, and to avoid the ground level concentration of the products of combustion from becoming prejudicial to health or a nuisance, or in the case of smaller units to prevent the flue gases from entering nearby buildings in too high a concentration. All chimneys must comply with the structural requirements of the Building Regulations 1972, but the control of the height or position of the terminal is now exercised under the provisions of the Clean Air Act 1968 or the Building Regulations 1972, according to the fuel consumption of the plant served by the chimney. Further control is available in the Public Health Act 1961 when a new building is proposed which will over-reach the chimney of an adjacent building and affect the dispersal of the products of combustion.

A The Clean Air Act 1968—Section 6

This section of the 1968 Act amends and extends the provisions of Section 10 of the Clean Air Act 1956, which it has largely replaced (except to control the height of chimneys serving non-combustion processes).

Under these provisions a local authority must consider a chimney height when:—

(i) a new chimney is erected to serve a new or existing furnace,
(ii) a furnace served by an existing chimney is enlarged, i.e. when its combustion space is increased, e.g. by the addition of a new furnace to an existing range of furnaces,
(iii) a furnace served by an existing chimney is removed and replaced by one having a larger combustion space,

but only if the furnace:—

(*a*) burns or is to burn pulverised fuel; or
(*b*) burns or is to burn at a rate of 100 lbs. or more an hour any other solid matter; or
(*c*) burns or is to burn at a rate equivalent to 1¼ million Btu or more per hour any liquid or gaseous matter.

An application for chimney height approval should preferably be on the form prescribed in the Clean Air (Heights of Chimneys) (Prescribed Form) Regulations 1969 (Statutory Instrument 1969 No. 412) but this does not preclude the local authority from considering an application even though not on the prescribed form, if the information provided by the applicant is sufficient.

The local authority must consider an application and give a written decision within 28 days of receiving the application, unless it is agreed in writing between the local authority and the applicant that a longer period may be allowed; the local authority, however, must not approve the proposed chimney height unless they are satisfied that it will be sufficient to prevent, so far as is practicable, the smoke, grit, dust, gases or fumes emitted from the chimney from becoming prejudicial to health or a nuisance, having regard to:—

(i) the purpose of the chimney,
(ii) the position and descriptions of buildings near to it,
(iii) the levels of the neighbouring ground,
(iv) any other matters requiring consideration in the circumstances.

Any approval of the height of a chimney may be granted unconditionally or subject to conditions as to the rate and/or quality of emissions from the chimney.

"rate of emission" is defined as the quantities of any specified substance which may be emitted in a period specified in the conditions attached to the approval, e.g. lbs./hr. of sulphur dioxide.

Many other miscellaneous emissions may, of necessity, be considered for inclusion in conditions as to the rate of emission, but there will be cases where a limitation on "rate" alone will not sufficiently ensure against excessive pollution by materials other than normal combustion products, and in those cases it might be appropriate to impose conditions as to the "quality" (i.e. concentration) of the emission.

A limitation on the quality of emission would be appropriate if the products of combustion contain gases or acid mists resulting from abnormal reactions or breakdown of materials derived from chlorinated or sulphur bearing compounds, etc., or if products of combustion are mixed with waste gases from non-combustion processes.

There will also be occasions, particularly in relation to metallurgical processes, where the optical density of emissions may be regulated by reference to percentage obscuration or perhaps by reference to the Bacharach scale.

If a local authority fails to give a written decision within 28 days, the approval applied for is deemed to be granted without qualification.

If the local authority decide not to approve the height of a chimney or to attach conditions to their approval, they must give the applicant a written notification of their decision, stating their reasons, and they must additionally specify the lowest height, if any, which they are prepared to approve unconditionally and/or the lowest height they are prepared to approve with any specified conditions. The applicant may, within 28 days, appeal against the decision to the Secretary of State for the Environment, or the Secretary of State for Wales or for Scotland as appropriate.

In the event of an appeal being lodged, the Secretary of State may confirm the decision against which the appeal is made, or may amend the height or conditions as he thinks appropriate. He must also give a written notification of his decision stating his reasons and, where he does not approve a chimney height, specifying what height, with and/or without conditions, he would approve.

It is not necessary to apply for chimney height approval for any exempted boiler or plant, and the Secretary of State has made the Clean Air (Heights of Chimneys) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 411).

These Regulations provide in substance that chimney height approval is not required where a boiler or plant is used:—

(i) as temporary replacement for a boiler or plant which is under inspection or being maintained, repaired, rebuilt, or replaced by another permanent boiler or plant;
(ii) as a temporary source of heat or power for building or engineering construction work;
(iii) as a temporary source of heat or power for investigation or research;
(iv) as an auxiliary plant used to bring other plant to an operating temperature;
(v) as a mobile or transportable source of heat or power for agricultural operations.

Although a boiler or plant, when used wholly for one of the prescribed purposes, is exempt from the provisions requiring the height of the chimney to be approved, it is nevertheless subject to the other relevant provisions of the Clean Air Acts, and to the nuisance provisions of the Public Health Act 1936.

The Practical Determination of the Height of Chimneys Controlled Under the Clean Air Act 1968

Products of combustion emitted from chimneys serving furnaces burning conventional solid, liquid or gaseous fuels may contain:—

(*a*) *Solids*
Smoke, dust, ash, grit, fume.

(*b*) *Gases*
Carbon monoxide, carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen, hydrocarbons, oxygen and nitrogen; and a number of other minor constituents, including a host of trace elements.

By good combustion and the installation of efficient arrestors, the emission of solids, and to a lesser extent some of the gases, can be minimised, but removal of, for instance, sulphur dioxide is impracticable and the gases must therefore be discharged through a chimney of adequate height.

The basic thesis in the use of tall chimneys for waste gas dispersal is that there are no such things as dangerous gases or fumes, only dangerous concentrations.

The function of the chimney is to reduce the resulting ground level concentration of each constituent of the emission so that it is below the threshold which gives rise to a health hazard or a nuisance.

Under ideal conditions, and so far as gases are concerned, the ground level concentrations from a chimney discharge vary directly with the mass rate of emission and inversely with the wind speed and the square of the effective chimney height. Maximum ground level concentrations occur at about 10–15 times effective chimney heights distance.

Until the first edition of the Memorandum on Chimney Heights issued by the Ministry of Housing and Local Government in 1963, local authorities had a number of formulae which they could use for the calculation of a chimney height, particularly those recommended by the Beaver Committee in Appendix VI of its Final Report.

Revised in October 1967, the Memorandum on Chimney Heights still follows the basic principle in the amended edition that the pollution downwind from a chimney should not exceed a predetermined limit and that pollutants from the chimney must be considered in relation to pollution which exists from other sources.

Using either an average sulphur content for coal and oil of 1·6% and 3% respectively, or preferably using the known sulphur content, it is easy to calculate the mass emission of SO_2 (not forgetting that in the case of coal, 10% of the sulphur remains in the ash). In practice, because of the tremendous variation in sulphur content of coal it is usual to take the average of 1·6% for determining chimney heights, but to use the specification maximum for a particular class of oil when that fuel is to be used. It is also usual to base the fuel consumption on the maximum continuous rating of the boiler or other plant. Thus the chimney height is based on the maximum possible SO_2 emission from the plant and gives the industrialist some flexibility in the amount of fuel he might then burn without contravening the Act.

In the Memorandum, after the introduction of a description of the method, are printed a number of charts which allow firstly an uncorrected chimney height to be obtained based on SO_2 emission and the type of locality; and secondly a final height to be obtained by relating the uncorrected height to the height and/or length of the building in which the furnace is installed or the height of adjacent buildings.

An accurate assessment of the type of locality is important in determining the uncorrected chimney height, and the Memorandum gives the following guidance:—

(*a*) An undeveloped area where development is unlikely, where background pollution is low, and where there is no development within half a mile of the new chimney.
(*b*) A partially developed area with scattered houses, low background pollution, and no other comparable industrial emissions within a quarter of a mile of the new chimney.
(*c*) A built-up residential area with only moderate background pollution and without other comparable industrial emissions.
(*d*) An urban area of mixed industrial and residential development, with considerable background pollution and with other comparable industrial emissions within a quarter of a mile of the new chimney.
(*e*) A large city, or an urban area of mixed heavy industrial and dense residential development, with severe background pollution.

Category *c* represents average conditions, whilst categories *a*, *b*, *d* and *e* represent adjustments up or down, according to probable existing background pollution. Thus a chimney will be lower in Area *a* than in Area *c*, and highest in Area *e*.

It is emphasised that the Memorandum provides a relatively simple method of calculating the approximate chimney height commonly desirable in normal circumstances. There will sometimes, however, be occasions involving complex developments, or topographical complications, which are impossible to assess precisely by either experience or mathematics and it will then be necessary to have wind tunnel tests carried out on scale models.

Heights of Chimneys Serving Furnaces Not Burning Sulphur Bearing Fuels

The Memorandum can be utilised for determining stack heights only if the "fuel" contains sulphur in significant proportions, and there are no constituents of the chimney gases that are of more importance in relation to public health or nuisance than sulphur dioxide. Where there is no SO_2 emission, or where other constituents are of more importance, the height of the chimney cannot be assessed by use of the Memorandum on Chimney Heights. During 1970 the Warren Spring Working Group on Chimney Heights was reconstituted to produce a report recommending chimney heights for furnaces to burn natural gas, towns gas, liquid petroleum gas and low sulphur fuel oils. The working group is expected to produce its report during 1976.

B Clean Air Act 1956—Section 10

Although Section 10 of the 1956 Act no longer applies to a chimney serving a furnace, it will still apply to a chimney serving a non-combustion process, providing Building Regulation plans are required to be submitted for local authority approval. If the chimney is insufficient to prevent the emissions from becoming prejudicial to health or a nuisance, the local authority must reject the plans, and an aggrieved applicant may appeal to the Secretary of State for the Environment.

C. The Building Regulations 1972

The earlier notes show that the Clean Air Acts control chimney heights only if the fuel consumption is 100 lbs. or 1·25 million Btu or more per hour.

The Building Regulations 1972 apply to *all* chimneys irrespective of the capacity of the fireplace or furnace, no matter in what type of building the unit is installed.

Regulation L2(4)(*a*) requires that the flue outlet of a high rating appliance shall be so situated as to prevent the discharge therefrom into the external air from entering any opening into a building in such a concentration as to be prejudicial to health or a nuisance.

A "high rating appliance" is defined as
  (*a*) a solid fuel burning appliance or oil burning appliance with an output rating exceeding 45 kw.
  (*b*) a gas appliance having an input rating exceeding 45 kw.
  (*c*) an incinerator having a refuse combustion chamber exceeding 0·08m^3 in capacity.

In the case of Class I or Class II appliances the flue terminals must be correctly placed in accordance with Regulations 13 and 21 respectively.

A "Class I appliance" is defined as
  (*a*) a solid fuel appliance or oil burning appliance having an output rating not exceeding 45 kw.
  (*b*) an incinerator having a refuse combustion chamber capacity between 0·03m^3 to 0·08m^3.

A "Class II appliance" is defined as
  (*a*) a gas appliance having an input rating not exceeding 45 kw.
  (*b*) an incinerator having a refuse combustion chamber not exceeding 0·03m^3 in capacity.

D Public Health Act 1961

Section 28 of this Act applies when a new building is erected which will overreach the chimney of an adjoining building.

Providing that the chimney of the lower building is in the party wall between it and the taller building, or is 6 feet or less from the taller building, the local authority may by notice require the person who erects the taller building to raise the height of the chimneys of the adjoining building if it is reasonably practicable to do so, so that the chimneys are the same height as the taller building or its chimneys, whichever is the higher.

The notice will also require the owner or occupier of the adjoining building to allow the work to be done, but he may elect to do the work himself and charge the reasonable cost of so doing to the person on whom the notice was served.

In the event of non-compliance with the notice, the local authority may do the work in default.

Chimney Design

It is essential to emphasise that whilst the physical and effective heights of any chimney are of importance in ensuring the eventual dispersion of the waste gases etc., other features of the chimney (e.g. its shape, quality of thermal insulation, and cross sectional area at the outlet) must be carefully designed if stack inversion, acid condensate, smut emission, and downwash are to be avoided.

Summary of the Provisions Relating to Chimney Heights

The occupier of premises must seek approval of a chimney height when:—

1. (i) a new chimney is to be erected,
   (ii) an existing furnace installation is to be enlarged,
   (iii) a furnace is to be replaced by one of larger combustion capacity,
   but only if the new or enlarged plant is to burn pulverised fuel; other solid matter at 100 lbs. or more per hour; or liquid or gaseous matter at 1·25 million Btu or more per hour.
2. The local authority must give a written decision within 28 days, and may prescribe conditions.
3. The applicant can appeal to the Secretary of State for the Environment within 28 days of receiving the local authority decision, if aggrieved by the decision or conditions.
4. Chimney height approval is not required for certain exempted plant—mainly of temporary or experimental nature.
5. All chimneys must comply with the relevant provisions of the Building Regulations 1972 as to the position of the terminal.
6. In general the Ministry Memorandum on Chimney Heights is used, unless there are parameters more important than SO_2 emission which must be considered.
7. In some circumstances, the developer of a tall building may be required to raise the height of the chimneys of an adjoining building.

3. THE CONTROL OF GRIT, DUST AND FUME EMISSIONS

Although "grit" is defined in the Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 as "particles exceeding 76 microns in diameter", and "fume" is defined in the 1968 Act as "solid particulate matter smaller than dust", there is no definition of "dust".

It is, however, generally accepted that "dust is particulate matter smaller than 76 microns with a lower limit of one micron" and "fume" is sub-micronic in size.

Under the provisions of the 1956 Act the underlying principle in relation to stack solids was that any practicable means should be used for minimising grit and dust emissions. The various definitions recognised that technical problems would prevent the

complete elimination of emissions and that the measures required would vary according to circumstances. The requirement for grit arrestors to be installed in connection with new plant related only to those burning pulverised fuel, or other solid matter at the rate of one ton or more per hour.

The provisions of the 1968 Act take these first principles a stage further and also allow the various provisions to be related to fume emission as and when the Secretary of State feels the time to be appropriate.

The new provisions considerably strengthen and extend the local authority powers in relation to this problem, and since they are of fundamental importance they are set down under a series of sub-headings.

A Power of the Secretary of State to Prescribe Limits of Emission

Section two of the 1968 Act gives the Secretary of State power to prescribe limits on the rates of emission of grit and dust from the chimneys of furnaces, and to prescribe different limits for different cases and according to different circumstances.

(i) Working Party on Grit and Dust Emissions

During 1964 the then Minister of Housing and Local Government was considering the possibility of making Regulations to enable local authorities to require industrialists to measure grit and dust emissions. He decided that before doing so it would be advisable for local authority staff to receive guidance as to the available methods of measuring grit and dust, and the levels of emission, from various types of plant, which would be acceptable. Accordingly a Working Party on Grit and Dust Emissions was convened with the following terms of reference:—

> "To consider ways and means of measuring grit and dust emissions and to advise on the levels of emission admissible in relation to furnaces burning fuel equivalent to 100 lbs. to 50,000 lbs. of coal per hour."

The Report, published in 1967 proposed limits on the acceptable levels of emission from coal fired and oil fired boilers, and from furnaces where the stock being heated does not contribute to the emissions.

The working party considered that there was insufficient reliable data of emissions from furnaces where the stock contributed to emissions, or from incinerators, and recommended that there should be initiated a systematic study to obtain emission data from a representative sample of these classes of furnaces and, at the same time, to obtain some reliable information on the current technology of emission prevention. This study has recently been undertaken by N.I.F.E.S.

Those recommendations included in the Report were stated in lbs./hour of grit and dust emitted during a period of normal operation, including peak loads. In the case of coal fired plant the acceptable emissions ranged from 1% of the fuel, fired at a low rate of burning (100 lbs./hour) to 0·5% of the fuel fired at the top rate of burning (50,000 lbs./hour); and in the case of oil fired plant the acceptable emissions reduced from 0·4% of the fuel fired at a low rate of burning to 0·2% of the fuel fired at the top rate of burning. In the case of coal fired plant the working party recommended that the percentage grit in the sample from plant burning up to one ton per hour should not exceed 33%, and from plant burning over one ton per hour should not exceed 20%.

The Report of the Working Party was later endorsed by the then Ministry of Housing and Local Government in its publication "Grit and Dust—The Measurement of Emissions from Boiler and Furnace Chimneys—Standard Levels of Emission."

(ii) The Clean Air (Emission of Grit and Dust from Furnaces) Regulations 1971 (Statutory Instrument 1971 No. 162)

The Regulations were made on the 1st February 1971, and came into operation on the 1st November 1971. They express in parliamentary and legal terminology the recommendations of the Working Party on Grit and Dust Emissions, but for a period until 1st January 1978 the Regulations will apply only to plant for which an agreement in respect of its purchase or installation was entered into after the date of operation i.e. there is a seven year exemption for existing installations.

The Regulations apply to:—

(*a*) boilers;
(*b*) indirect heating appliances (being heating appliances in which the combustion gases are not in contact with the material being heated);
(*c*) furnaces in which the combustion gases are in contact with the material being heated but that material does not in itself contribute to the grit and dust in the combustion gases.

The Regulations do not apply to incinerators burning refuse or waste matter (solid or liquid) whether or not the resulting heat is used for any purpose.

Schedules 1 and 2 of the Regulations tabulate the quantities of grit and dust which may be emitted, and where the rating of the boiler or furnace is intermediate between the tabulated values, the maximum permitted emission is obtained by interpolation:—

Schedule 1—Furnaces Rated by Heat Output

This schedule applies to boilers and also indirect heating appliances in which the material being heated is a gas or a liquid (e.g. an air heater) but where an indirect heating appliance falls also within the provisions of schedule 2, it shall be treated as schedule 1 furnace.

The amount of grit and dust which may be emitted is as follows:—

Max. Continuous Rating in lbs. of steam/hr. (from and at 100°C (212°F) *or in thousands of Btu/hr.*	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning solid matter	*Furnaces burning liquid matter*
,825	1·10	0·25
1,000	1·33	0·28
2,000	2·67	0·56
3,000	4·00	0·84
4,000	5·33	1·12
5,000	6·67	1·4
7,500	8·50	2·1
10,000	10·00	2·8
15,000	13·33	4·2
20,000	16·67	5·6
25,000	20·0	7·0
30,000	23·4	8·4
40,000	30	11·2
50,000	37	12·5
100,000	66	18
150,000	94	24
200,000	122	29
250,000	149	36
300,000	172	41
350,000	195	45
400,000	217	50
450,000	239	54·5
475,000	250	57

Schedule 2—Furnaces Rated by Heat Input

This schedule applies to indirect heating appliances and to furnaces in which the combustion gases are in contact with the material being heated, but that material does not in itself contribute to the grit and dust in the combustion gases.

The amount of grit and dust which may be emitted is as follows:—

Heat input in millions of Btu/hr.	*Max. permitted quantities of grit and dust in pounds per hour*	
	Furnaces burning Solid Matter	*Furnaces burning Liquid Matter*
1·25	1·1	0·28
2·5	2·1	0·55
5·0	4·3	1·1
7·5	6·8	1·7
10	7·6	2·2
15	9·7	3·3
20	11·9	4·4
25	14·1	5·5
30	16·3	6·6
35	18·4	7·7
40	20·6	8·8
45	22·8	9·8
50	25	10·9
100	45	16
200	90	26
300	132	35
400	175	44
500	218	54
575	250	57

The Regulations limit the grit in the sample of grit and dust to the following proportions:—

	Grit not to exceed 33%	*Grit not to exceed* 20%
Schedule One Furnaces	Where maximum continuous rating does not exceed 16,800 lbs./hr. of steam or 16,800,000 Btu/hr.	In any other case.
Schedule Two Furnaces	Where designed heat input of the furnace does not exceed 25,000,000 Btu/hr.	In any other case.

Grit is defined as those particles exceeding 76 microns in diameter (i.e. will remain on a BS.200 mesh sieve).

Multiflue chimneys are defined and for the purpose of the regulations each flue is to be taken as a separate chimney for the purpose of calculating acceptable emissions.

Where a chimney serves a furnace to which the regulations apply and also a furnace to which the regulations do not apply, the emissions from the latter shall be disregarded.

The prescribed limits apply to any period of standard operation of the furnace, including periods during which it is at or close to the loading to which it is subject for the greater part of its working time, or at any higher loading to which it is regularly subject for a limited time (whether or not this exceeds the furnace M.C.R. or designed heat input).

N.B. (1) Until the Regulations are made to apply to existing furnaces, or additional Regulations are made for furnaces where the material being heated contributes to the grit and dust emission, the occupier of the premises must use "any practicable means" for minimising the grit and dust emission.
(2) If the grit and dust emission from a chimney serving a furnace to which the Regulations apply, exceeds the permitted limit, there is a defence that the "best practicable means" had been used to prevent the emission.

The definition of "practicable" in the 1956 Act (it applies also to the 1968 Act) is of importance:—

> "Practicable" means reasonably practicable having regard, amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge, and "*practicable means*" *includes the provision and maintenance of plant and the proper use thereof.*

During 1972, the Secretary of State for the Environment appointed a new Working Party on Grit and Dust Emission with the following terms of reference:—

> "To advise on the levels of emission admissible under Section 2 of the Clean Air Act 1968 in relation to incinerators, and to furnaces where the material being heated contributes to the emission."

The Report of the Second Working Party on Grit and Dust Emission was published during 1974 and recommends maximum levels of emission of grit and dust from three broad classes of furnace.

(a) Incinerators
(b) Cupolas
(c) Miscellaneous furnaces

In presenting the Report, the Working Party stresses the difficulty of differentiating for emission control purposes between grit and dust on the one hand and sub micron fume on the other. They recommend that yet another Working Party should be established in the near future to further examine the difficult problem of fume emission measurement and control.

The Report again defines grit as that material larger in size than 75 microns in diameter; defines dust (for the first time) as material smaller than grit, and fume as particles less in size than one micron.

Notwithstanding the problems of measurement, particle size determination and control of emission, the Report makes firm recommendations for future legal limits of emission and should be consulted for detailed information. If, in due course, regulations are promulgated giving legal effect to the recommendations, they will be summarised in a future Year Book.

B Arrestment Plant for New Furnaces

Section 6 of the Clean Air Act 1956 required that certain larger new furnaces, the installation of which was commenced (or was subject to an agreement signed) between July 1956 and October 1969, should be equipped with approved grit and dust arrestment plant and that the arrestors must be properly maintained and used. These provisions still apply to furnaces which are used:—

(i) to burn pulverised fuel; or
(ii) to burn, at a rate of one ton an hour or more solid fuel in any other form or solid waste,

providing that the plant was installed or an agreement was signed between the above-mentioned dates.

Section 3 of the 1968 Act states that if new plant is to be installed after the 1st October 1969 (or is subject to an agreement signed after that date) and it is to be used

(*a*) to burn pulverised fuel; or
(*b*) to burn, at a rate of 100 pounds or more an hour, any other solid matter; or
(*c*) to burn, at a rate equivalent to 1¼ million or more British thermal units an hour, any liquid or gaseous matter,

it must, unless exemption has been provided, be equipped with grit and dust arrestment plant. In the event of a local authority refusing approval there is a right of appeal to the Secretary of State within 28 days of receiving the local authority's written decision.

Two types of exemption are possible by virtue of Section 4 of the 1968 Act:—

(i) The Secretary of State has power to provide in Regulations that furnaces of any particular class, whilst used for a prescribed purpose, should be exempted. He has now made the Clean Air (Arrestment Plant) (Exemption) Regulations 1969 (Statutory Instrument 1969 No. 1262) as follows:—

Class of Furnace	*Purpose*
1. Mobile or transportable furnaces.	(*a*) Providing a temporary source of heat or power during any building operation or work of engineering construction (within the meaning of section 176 of the Factories Act 1961); (*b*) providing a temporary source of heat or power for investigation or research; (*c*) providing heat or power for the purpose of agriculture (within the meaning of section 109(3) of the Agriculture Act 1947).
2. Furnaces, other than furnaces designed to burn solid matter at a rate of one ton an hour or more, which fall within any of the following descriptions and in which the matter being heated does not contribute to the emission of grit and dust:— (*a*) Furnaces burning liquid matter, gas, or liquid matter and gas; (*b*) hand-fired sectional furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*c*) magazine type gravity-fed furnaces designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*d*) furnaces fitted with an underfeed stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of the plan area of the combustion chamber; (*e*) furnaces fitted with a chain grate stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of grate surface; (*f*) furnaces fitted with a coking stoker designed to burn solid matter at a rate of not more than 25 lbs. an hour for each square foot of area covered by the fire bars excluding the solid coking plate.	Any purpose except the incineration of refuse

(ii) The local authority may, on application, exempt a specific furnace installation providing that they are satisfied that the emissions will not be prejudicial to health or a nuisance. The local authority must give a written decision within eight weeks, and an aggrieved applicant may appeal within a further 28 days, to the Secretary of State.

An offence occurs if a furnace is exempt and is then used for a purpose other than one prescribed in the exemption.

When considering an application for approval of a proposed arrestor plant (or an application for exemption from the need to install an arrestor plant) the local authority will have regard to the probable grit and dust burden in the flue gases, and to the known efficiency of the proposed arrestor plant in order that they might compare the probable emission with any standard which might at the time be in force or which is under consideration. Industrialists and consultants would, in turn, be wise to remember that the Working Party on Grit and Dust Emissions proposed that their recommended standard levels of emission should be reviewed after three years in operation and that arrestor plant, unless very well maintained at all times, rarely operates at design efficiency after a few years in use.

C The Measurement of Grit and Dust Emissions

The legal provisions concerning the measurement of grit and dust emissions are to be found in Section 7 of the 1956 Act as amended by Section 5 of the 1968 Act. Regulations have been made which prescribe the procedure to be followed by a local authority which wishes grit and dust measurement to be made and by the industrialist on whom a notice has been served.

If a furnace (or range of furnaces served by one chimney) is used to burn:—

(i) pulverised fuel, or
(ii) any other solid matter at a rate of 100 lbs. or more per hour, or
(iii) any liquid or gaseous matter, at a rate equivalent to 1¼ million or more Btu/hr.

the local authority may serve a notice on the owner of the plant or occupier of the building, requiring grit and dust emissions to be measured.

If the plant burns:—

(i) less than one ton/hour of solid matter other than pulverised fuel, or
(ii) less than 28 million Btu/hour of liquid or gaseous matter.

the industrialist may serve a "counter notice" on the local authority, requiring the authority to carry out the measurements at its own expense, and the local authority is obliged to do so "from time to time" unless the counter notice is, in writing, withdrawn.

The Clean Air (Measurement of Grit and Dust) Regulations 1971 (Statutory Instrument 1971 No. 161), prescribe the administrative process to invoke the above provisions (a similar set of Regulations apply to Scotland):

(*a*) A local authority must give at least six weeks' notice in writing to an industrialist requiring:—

(i) adaptations to be made to the chimney or flues, and
(ii) the provision of the necessary equipment,

to enable measurements to be made in accordance with BS.3405:1961 "Simplified Methods for Measurement of Grit and Dust Emission from Chimneys". The British Standard describes five different types of equipment which can be used, and it is necessary to ensure that the type and position of sampling points is correct in relation to the type of equipment which will be used. The British Standard is currently under review.

(*b*) When the sampling points have been installed and the equipment provided (or it is known that the firm are engaging a consultant who possesses the equipment), the local authority must give at least 28 days' notice in writing, requiring the tests to be carried out in accordance with the methods details in pp.13–26 of the B.C.U.R.A. publication "Measurements of Solids in Flue Gases".

(*c*) Before making the measurement, the industrialist must give the local authority at least 48 hours' notice in writing, of the date and time of the commencement of the tests.

(*d*) The 1968 Act requires the industrialist to permit the local authority to be represented during the tests.

(*e*) The result of the test must be sent to the local authority within 14 days from the making of the measurements, and the reports shall include:—

(i) the date(s) of the test(s);
(ii) the number of furnaces discharging into the chimney on that date;
(iii) the results of the measurements expressed in lbs./hour of grit and dust emitted, and in the case of solid fuel fired plant, the percentage of grit in the solids.

A notice may require the making of measurements from time to time or at stated intervals, but not at intervals of less than 3 months unless in the opinion of the local authority, the true level of emission cannot be determined without further measurement being made.

If an industrialist serves a "counter-notice" on the local authority, he need comply only with the (*a*)(i) above, i.e. make adaptations to the chimney to enable the measurement to be made, including the provision of scaffolding where necessary, and the provision of facilities such as electrical connections to enable the sampling equipment to be used. The local authority must provide the sampling equipment and conduct the test entirely at its own expense.

In various circulars and publications, the Ministry of Housing and Local Government, and the Working Party have emphasised that the measurement of grit and dust emissions is both time consuming and costly. It is unlikely, therefore, that local authorities will authorise the indiscriminate service of hundreds of notices on industrialists, but will concentrate in the first instance on those units which are thought to be giving rise to complaint of nuisance, or which they suspect are emitting solids grossly in excess of the proposed limits. In any event the majority of local authorities have still to arrange for their staff to be trained in the use of the sampling equipment.

D Fume Emission

Fumes are defined in the 1968 Act as "any airborne solid matter smaller than dust", and by this definition acid mist or liquid droplets are thereby excluded.

By virtue of the 1968 amendment to the definition of chimney in the 1956 Act, this now "includes structures and openings of any kind from or through which smoke, grit, dust or fumes may be emitted, and in particular includes flues".

There are, at the moment, no legal provisions which require the reduction or elimination of fume emissions, other than those specific fumes which are controlled by the Alkali Inspectors under the provision of the Alkali &c. Works Regulation Act 1906, as amended and extended by the Clean Air Acts 1956 and 1968, and by the Alkali Works Order 1966.

An important provision in the 1968 Act for possible future consideration is the power in Section 7 of the Secretary of State to apply to "fumes", certain provisions of the 1956 and the 1968 Acts, i.e. by Regulations the Secretary of State may apply the following provisions to fumes, as they apply to grit, dust or smoke:—

(*a*) **Clean Air Act 1956—Section 3**
Requirement that new furnaces shall be so far as practicable smokeless "*and fumeless*".

(*b*) **Clean Air Act 1968—Section 2**
Emissions of grit, dust "*and fumes*" from furnaces (standard levels of emission).

Clean Air Act 1968—Section 3

Requirements to fit arrestment plant (*including fume arrestors*) to new furnaces.

Additionally, the Secretary of State has power to extend certain exemption provisions so that they relate to fume emissions or avoid the need to install fume arrestment plant.

4. MISCELLANEOUS PROVISIONS OF THE CLEAN AIR ACTS 1956 AND 1968 AND THE BUILDING REGULATIONS 1972

A. The Clean Air Act 1956 Section 4—Smoke Density Meters

This Section enables the Secretary of State to make Regulations requiring the installation, maintenance and use of smoke density meters and/or recorders obligatory.

No regulations have yet been made and it is thought that this is because, although smoke density meters can be fairly reliable, they are easily subjected to abuse and the results obtained can be varied almost at will by altering the calibration or failing to clean the viewing glasses, etc., which protect the light source and receiver.

Section 8—Information About Furnaces and Fuel Consumed

The local authority is empowered, by this section, to require an industrialist to supply information within 14 days as to the size of furnaces and fuel consumption but this information, in the vast majority of cases is provided willingly and voluntarily.

Section 18—Colliery Spoilbanks (including Waste Quarry-Shale)

Where a spoilbank is emitting smoke and fumes, or is likely to emit smoke and fumes, the following provisions apply:—

(*a*) **A spoilbank in use as at 5th July 1956, or commenced since that date**

The owner of the mine or quarry is required to employ all practicable means for preventing spontaneous combustion and for preventing emission of smoke and fumes.

(*b*) **A spoilbank the use of which had ceased by 5th July 1956**

If the spoilbank was no longer in use and its control had passed from the owner of the mine or quarry on or before the 5th July, 1956, the problem must be dealt with as a statutory nuisance under the provisions of Part III of the Public Health Act 1936 as amended.

Section 19—Railway Engines

Railway engines are subject to the dark smoke provisions of Section one of the 1956 Act, but are not subject to grit and dust emission provisions, nor to a Smoke Control Order.

Section 20—Vessels

Emission of smoke from vessels has been considered on a previous page.

Section 21—Exemption for Purposes of Investigation and Research

This section gives the local authority power to exempt a particular chimney, boiler or furnace, etc., from varying provisions of the Act when it is expedient to do so, to enable investigations or research relevant to air pollution to be carried out without rendering the applicant liable to proceedings.

If the local authority refuse exemption, the applicant has a right of appeal to the Secretary of State for the Environment.

Section 22—Crown Premises

In the event of excessive emissions of smoke, grit and dust from Crown premises, the local authority should notify the Minister responsible for the premises and he shall take appropriate action to prevent or minimise the emission.

Section 23—Clean Air Council

By means of this section the Secretary of State has established the Clean Air Council with one of his Junior Ministers as Chairman to review progress and obtain advice on air pollution matters. There is also a Clean Air Council for Scotland (Statutory Instrument 1957 No. 766).

Sections 25-29* (Modified and partly repealed by CPA 1974)

These sections are mainly administrative and relate to research and publicity, improper disclosure of information by an officer, penalties for offences under the Act (Some of which have been increased by the Criminal Justice Act 1967), authorisation of works, and enforcement of the Act.

B. The Clean Air Act 1968

The only important provisions of this Act not previously mentioned are contained in section 11 and relate to registered processes under the Alkali Act. The section substantially repeals section 17 of the 1956 Act, and in particular removes the power of the local authority to apply to the Secretary of State for authority to institute proceedings in the event of excessive smoke, grit, dust, etc., from registered processes. It also brings within the control of the Alkali Acts "work subject or potentially subject to the Alkali Act".

Building Regulations—Prevention of Smoke Emission

The Building Regulations 1972, include a section, M2, relating to the prevention of emission of smoke. The full text of the section is:—

> "M2. In any building (other than a building erected under former control) there shall not be installed for the purposes of heating or cooking in that or any other building any appliance which discharges the products of combustion into the atmosphere, unless that appliance is designed to burn as fuel either gas, coke, or anthracite. Provided that nothing in this regulation shall prohibit the installation of:—
>
> (i) a furnace which complies with Section 3 of the Clean Air Act 1956; or

(ii) an appliance of a class exempted conditionally or unconditionally from the provisions of Section 11 of the Clean Air Act 1956 (which relates to smoke control areas) by any order for the time being in force under subsection (4) of that section; or

(iii) a solid fuel appliance with a bottom grate unsuitable for burning coke or anthracite but designed so as to be capable of use with an alternative bottom grate which is suitable for burning such fuel.

5. THE CONTROL OF POLLUTION ACT 1974

This Act, *when fully operative,* will

(i) enable the Ministers to
  (*a*) regulate the composition of motor fuel,
  (*b*) impose limits on the sulphur content of oil fuel for use in furnaces etc.
  (*c*) require local authorities to monitor air pollution as directed by the Minister.
(ii) Modify the Aklali Act 1906 and the Clean Air Act 1968.
(iii) Substantially extend and amend the provisions of the Clean Air Acts in relation to
  (*a*) research and publicity on air pollution,
  (*b*) obtaining information about emissions to atmosphere.
(iv) Raise the penalties in the Public Health Acts and Clean Air Acts for offences under Clean Air and related legislation.

Section 75—Regulations about Motor Fuel

This section will enable the Secretary of State to make Regulations limiting the composition and contents of any motor fuel and to prevent or restrict the production, treatment, distribution, import, sale or use of any fuel which fails to comply with the requirements and which is for use in the United Kingdom.

The Secretary of State must consult with various bodies before making the Regulations.

Generally, these provisions will be enforced by the Weights and Measures Authorities, who in England and Wales are the County Councils; certain powers of sampling, power of entry, etc., contained in the Trades Descriptions Act will apply to these provisions.

Section 76—Regulations about Sulphur Content of Oil Fuel

Under these provisions, the Secretary of State will be empowered, after consultation, to limit the sulphur content of a wide range of fuel oils used in inudstry, commerce and in domestic boilers etc.

The section provides flexibility for the Secretary of State to be selective in the controls he imposes.

Local Authorities (and in some cases the Health and Safety Executive) will be responsible for the enforcement of the Regulations in due course.

Section 78—Cable Burning

This section modifies the Alkali Act 1906 (as amended by the Clean Air Act 1968) to create an offence of "cable burning" unless the place at which the burning takes place is registered under the provisions of the Alkali Act. The section specifies that H.M. Alkali and Clean Air Inspectorate have authority to prosecute for an offence under this section, but local authorities must apply to the Secretary of State for permission to do so.

Section 79—Research and Publicity

This section modifies and extends the local authority powers in the 1956 Act to undertake research and publicity projects into air pollution.

They are empowered to serve notices to obtain information on emissions of pollutants and to either themselves enter onto premises to measure and record emissions or to agree with occupiers of premises that they should do the work on behalf of the local authority.

The local authority must, if it wishes to monitor the emissions itself, serve a 21 day notice on the occupier

(i) specifying the kinds of emissions in question and how it proposes to monitor them,
(ii) indicating that it will do the necessary work unless the occupier chooses to serve a counter-notice bringing into effect section 80 of the Act (local authority notice requiring the occupier to provide the necessary information within a period of six weeks).

The local authority may not enter onto Alkali Registered Works to monitor emissions, but they may serve a notice under section 80, or may monitor the ambient concentration of pollutants in the atmosphere *without entering the Works.*

A local authority may not publish information obtained

(i) by monitoring emissions,
(ii) by service of notice under section 80, or
(iii) by entering into arrangements with occupiers unless they have previously consulted with the industry or trade in their area and/or with any air pollution experts and/or with amenity organisations as appear to be appropriate.

The material, when published, must not disclose a trade secret except with the consent in writing of the person authorised to disclose it, or with the consent of the Secretary of State.

Section 80—Notices Requiring Information about Air Pollution

The section 80 notices referred to previously are served by the local authority when it requires information about emission of pollutants and requires the occupier of the premises to provide the information himself within six weeks or such longer period as allowed. In relation to Alkali Registered Works, the local authority can require information only of a kind which is being supplied to H.M. Alkali and Clean Air Inspectorate.

Notices may require periodical returns or single event emission data; but if periodical returns are requested, the interval between returns shall be not less than three months, and no one return is to cover a period of more than twelve months.

Section 81—Appeals against Notice

A person on whom a section 80 notice is served may appeal to the Secretary of State

(*a*) on the grounds that disclosure would
  (i) unreasonably prejudice some private interest, or
  (ii) be contrary to public interest, or

(*b*) on the grounds that the information is not readily available and cannot be readily collected without incurring undue expenditure.

The Secretary of State may make Regulations as to appeals under this section including the timing of appeals and the circumstances in which all or any part of the appellant's case may be withheld from the local authority. If the appeal is upheld, the Secretary of State may direct the local authority to withdraw or modify the notice, or to take steps to ensure that prejudicial information is not disclosed to the public.

Section 82—Regulations about Research and Publicity

This section provides powers for the Secretary of State to make wide ranging Regulations to prescribe the manner in which and the methods by which local authorities are to perform their functions under sections 79 and 80 of the Act.

Section 83—Provision by Local Authorities of Information for Secretary of State

These powers enable the Secretary of State after consultation with a local authority to direct it to monitor air pollution and to send the information so obtained to him.

However, if the local authority install apparatus provided in pursuance of a direction, they may claim from the Secretary of State the capital cost of providing and installing the equipment.

SCHEDULE TWO
PENALTIES UNDER CLEAN AIR AND PUBLIC HEALTH LEGISLATION

The Control of Pollution Act substantially increases the **maximum** penalties for offences under Clean Air and Public Health legislation:—

(*a*) **Public Health Act 1936—Part III**
  (i) Non-compliance with an Abatement Notice—increase from £20 to £200,
  (ii) Non-compliance with a Nuisance Order—increase from £50 and £5 per day, to £400 and £50 per day.

(*b*) **Clean Air Act 1956**
  (i) Emission of dark smoke from private dwelling—increase from £20 to £100.
  (ii) Emission of dark smoke from other buildings—increase from £100 to £400 or in the case of a vessel to £1,000.
  (iii) Failure to notify installation of furnace or emission of smoke from a building in a smoke control area—increase from £20 to £100.
  (iv) Unlawful disclosure of information—increase from £100 to £400.
  (v) In other cases where £100 is mentioned, this is increased to £400.
  (vi) In other cases where £20 is mentioned, this is increased to £50.

(*c*) **Clean Air Act 1968**
Generally, the maximum penalties are increased from £100 to £400, but with the one exception relating to the sale of unauthorised fuel in a Smoke Control Area, in which case the maximum penalty is increased from £20 to £100.

SCHEDULE THREE

Amendment to Section 30 of the Clean Air Act 1956

Section 30 of the 1956 Act which provides for an early notification of an offence to be confirmed in writing within 48 hours, is amended so that the offence must be confirmed before the end of *4 days* following the day on which the offence occurred.

Amendment to Section 95 of the Housing Act 1964

Section 95, which allows the local authority to exclude certain designated heating appliances from smoke control grant is now amended to enable the Secretary of State, when confirming an order in which a designation is included, to direct that the designation is modified or removed.

6. HEALTH AND SAFETY AT WORK ETC ACT 1974

1. The main purpose of this Act is to provide a comprehensive and integrated legal and administrative system for securing the health, safety and welfare of persons at work and for protecting other persons against risks to health or safety arising from the activities of persons at work. To this end all the separate Inspectorates and agencies at present involved in these matters have been brought together in a Health and Safety Executive under a Health and Safety Commission. The Commission was set up on 1 October 1974 and the Executive on 1 January 1975.
2. Initially these bodies will be responsible for enforcing the existing mass of legislation (including the Alkali Act 1906 but not the Clean Air Acts), but this legislation will be progressively repealed and replaced by the provisions in the 1974 Act itself and by Health and Safety Regulations made thereunder. On 1 January 1975 those parts of the Alkali Act relating to the appointment and powers of Inspectors were repealed, being superseded by the general powers in the 1974 Act. The remainder of the Alkali Act will be repealed and replaced by regulations. (N.B. Certain obsolete sections of the Alkali Act were repealed by the Control of Pollution Act 1974).
3. The concept of best practicable means is retained in section 5(1) of the 1974 Act, which places a general duty on persons in control of premises of a class prescribed under section 1(1)(d) to use the best practicable means for preventing the emission into the atmosphere of noxious or offensive substances and for rendering harmless and inoffensive such substances as may be emitted. The few absolute standards in the Alkali Act will disappear. Best practicable means may be defined for individual processes by the Commission, probably in codes of practice approved by the Secretary of State. The list of registrable processes now contained in the Alkali Etc. Works Orders of 1966 and 1971 will be re-promulgated in Health and Safety Regulations. Section 5(2) of the 1974 Act also provides that a list may be prescribed of those substances which shall be deemed to be included within the definition "noxious or offensive".
4. The maximum penalty for breaching the general duty under section 5(1) is, on summary conviction a fine of £400, and on indictment imprisonment for two years and/or an unlimited fine.
5. Local authorities will continue to be responsible for the control of air pollution (including under the Clean Air Acts) from all premises not prescribed under the 1974 Act.
6. The processes currently registrable under the Alkali Act and the list of noxious or offensive gases are as follows:

REGISTRABLE WORKS

Non-Scheduled Works

1. Alkali Works
Works for:

(*a*) The manufacture of sulphate of soda or sulphate of potash, or

(*b*) The treatment of copper ores by common salt or other chlorides whereby any sulphate is formed,
in which muriatic acid gas is evolved.

Scheduled Works

1. Sulphuric Acid Works

Works in which the manufacture of sulphuric acid is carried on by the lead chamber process, namely, the process by which sulphurous acid is converted into sulphuric acid by the agency of oxides of nitrogen and by the use of a lead chamber or by any other process involving the use of oxides of nitrogen.

2. Sulphuric Acid [Class II] Works

Works in which the manufacture of sulphuric acid is carried on by any process other than the lead chamber process, and works for the concentration or distillation of sulphuric acid.

3. Chemical Manure Works

Works in which the manufacture of chemical manure is carried on, and works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid and works for the granulating of chemical manures involving the evolution of any noxious or offensive gas.

4. Gas Liquor Works

Works [not being sulphate of ammonia works or muriate of ammonia works] in which sulphuretted hydrogen or any other noxious or offensive gas is evolved by the use of ammoniacal liquor in any manufacturing process, and works in which any such liquor is desulphurized by the application of heat in any process connected with the purification of gas.

5. Nitric Acid Works

Works in which the manufacture of nitric acid is carried on and works in which nitric acid is recovered from oxides of nitrogen and works where in the manufacture of any product any acid-forming oxide of nitrogen is evolved.

6. Sulphate of Ammonia Works, and Muriate of Ammonia Works

Works in which the manufacture of sulphate of ammonia or of muriate of ammonia is carried on.

7. Chlorine Works

Works in which chlorine is made or used in any manufacturing process.

8. Muriatic Acid Works

(*a*) Muriatic acid works, or works [not being alkali works as defined in the Act] where muriatic acid gas is evolved either during the preparation of liquid muriatic acid or for use in any manufacturing process or as the result of the use of chlorides in a chemical process;

(*b*) Tinplate flux works, works in which any residue or flux from tinplate works is calcined for the utilization of such residue or flux, and in which muriatic acid gas is evolved; and

(*c*) Salt works, works [not being works in which salt is produced by refining rock salt, otherwise than by the dissolution of rock salt at the place of deposit] in which extraction of salt from brine is carried on, and in which muriatic acid gas is evolved.

9. Sulphide Works

Works in which sulphuretted hydrogen is evolved by the decomposition of metallic sulphides, or in which sulphuretted hydrogen is used in the production of such sulphides, or any works in which sulphuretted hydrogen is evolved as part of a chemical process.

10. Alkali Waste Works

Works in which alkali waste or the drainage therefrom is subjected to any chemical process for the recovery of sulphur or for the utilization of any constituent of such waste or drainage.

11. Venetian Red Works

Works for the manufacture of Venetian red, crocus or polishing powder, by heating sulphate or some other salt of iron.

12. Lead Deposit Works

Works in which the sulphate of lead deposit from sulphuric acid chambers is dried or smelted.

13. Arsenic Works

Works for the preparation of arsenious acid, or where nitric acid or a nitrate is used in the manufacture of arsenic acid or an arseniate and works in which any volatile compound of arsenic is evolved in any manufacturing process and works in which arsenic is made.

14. Nitrate and Chloride of Iron Works

Works in which nitric acid or a nitrate is used in the manufacture of nitrate or chloride of iron.

15. Bisulphide of Carbon Works

Works for the manufacture, use or recovery of bisulphide of carbon.

16. Sulphocyanide Works

Works in which the manufacture of any sulphocyanide is carried on by the reaction of bisulphide of carbon upon ammonia or any of its compounds.

17. Picric Acid Works

Works in which nitric acid or a nitrate is used in the manufacture of picric acid.

18. Paraffin Oil Works

Works in which crude shale oil is refined.

19. Bisulphite Works

Works in which sulphurous acid is used in the manufacture of acid sulphites of the alkalis or alkaline earths and works for the manufacture of liquid sulphur dioxide or of sulphurous acid or of any sulphite and works [not being smelting works as defined in section 8, sub-section [1] of the Act of 1906 or other works defined elsewhere in this schedule] in which oxides of sulphur are evolved in any chemical manufacturing process.

20. *Tar Works*

Works where gas tar or coal tar is distilled or is heated in any manufacturing process and works in which creosote or any other product of the distillation of gas tar or coal tar is distilled or is heated in any manufacturing operation involving the evolution of any noxious or offensive gas.

21. *Zinc Works*

Works in which by the application of heat, zinc is extracted from the ore, or from any residue containing that metal, and works in which compounds of zinc are made by dry processes giving rise to fume.

22. *Benzene Works*

Works [not being tar works as already defined] in which any wash oil used for the scrubbing of coal gas is distilled, or in which any crude benzol is distilled.

23. *Pyridine Works*

Works in which pyridine or picolines are recovered or made.

24. *Bromine Works*

Works in which bromine is made or is used in any manufacturing operation.

25. *Hydrofluoric Acid Works*

Works in which hydrofluoric acid is evolved in the manufacture of liquid hydrofluoric acid or its compounds.

26. *Cement Production Works*

Works in which argillaceous and calcareous materials are used in the production of cement clinker and works in which cement clinker is ground or cement is packed.

27. *Lead Works*

Works [not being works for the recovery of lead from scrap by direct liquation] in which, by the application of heat, lead is extracted from any material containing lead or its compounds, and works in which compounds of lead are manufactured from metallic lead or its compounds by dry processes which give rise to dust or fume.

28. *Fluorine Works*

Works in which fluorine or its compounds with other halogens are made or used in any manufacturing process, and works for the manufacture of fluorides, borofluorides or silicofluorides.

29. *Acid Sludge Works*

Works in which acid sludge produced in the refining of coal tar, petroleum or other hydrocarbon derivatives is treated in such manner as to cause the evolution of any noxious or offensive gas.

30. *Iron Works and Steel Works*

Works in which:

(*a*) iron or ferro-alloys are produced in a blast furnace and in which raw materials for use in blast furnaces are handled or prepared; or

(*b*) iron ores for use in blast furnaces are calcined or sintered; or

(*c*) iron or steel is melted in cupolas employing a heated air blast, or in electric arc furnaces; or

(*d*) steel is produced, melted or refined in Bessemer, Tropenas, open hearth or electric arc furnaces; or

(*e*) oxygen or air enriched with oxygen is used for the refining of iron or for the production, shaping or finishing of steels; or

(*f*) ferro-alloys are made by processes giving rise to fume.

31. *Copper Works*

Works in which:

(*a*) by the application of heat
  - (i) copper is extracted from any ore or concentrate or from any material containing copper or its compounds; or
  - (ii) molten copper is refined; or
  - (iii) copper or copper alloy swarf is degreased; or
  - (iv) copper alloys are recovered from scrap fabricated metal, swarf or residues by processes designed to reduce the zinc content; or

(*b*) copper or copper alloy is melted and cast in moulds the internal surfaces of which have been coated with grease-bound or oil-bound dressings. [But this paragraph does not apply to works in which the aggregate casting capacity does not exceed 10 tons per day.]

32. *Aluminium Works*

Works in which:

(*a*) aluminium swarf is degreased by the application of heat; or

(*b*) aluminium or aluminium alloys are recovered from aluminium or aluminium alloy scrap fabricated metal, swarf, skimmings, drosses or other residues by melting but not including works in which aluminium or aluminium alloys are separated from ferrous metals by liquation in sloping heater furnaces; or

(*c*) aluminium is recovered from slag; or

(*d*) molten aluminium or aluminium alloys are treated by any process involving the evolution of chlorine or its compounds; or

(*e*) aluminium is extracted from any material containing aluminium by a process evolving any noxious or offensive gases; or

(*f*) oxide of aluminium is extracted from any ore

and materials used in the above processes or the products thereof are treated or handled by methods which cause noxious or offensive gases to be evolved.

33. *Electricity Works*

Works in which:

(*a*) solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of public transport; or

(*b*) boilers having an aggregate maximum continuous rating of not less than 450,000 lbs. of steam per hour and normally fired by solid or liquid fuel are used to produce steam for the generation of electricity for purposes other than those mentioned in the preceding paragraph.

34. *Producer Gas Works*

Works in which producer gas is made from coal and in which raw producer gas is transmitted or used.

35. *Gas and Coke Works*

Works [not being producer gas works] in which:

(*a*) coal, oil or mixtures of coal or oil with other carbonaceous materials or products of petroleum refining or natural gas or methane from coalmines or gas derived from fermentation of carbonaceous materials are handled or prepared for carbonisation or gasification or reforming and in which these materials are subsequently carbonised or gasified or reformed; or

(*b*) Water gas is produced or purified; or

(*c*) coke or semi-coke is produced and quenched, cut, crushed or graded; or

(*d*) gases derived from any process mentioned in paragraph (*a*) are subjected to purification processes.

36. Ceramic Works

Works in which:

(*a*) pottery products [including domestic earthenware and china sanitary ware, electrical porcelain, glazed tiles and teapots] are made in intermittent kilns fired by coal or oil; or

(*b*) heavy clay or refractory goods are fired by coal or oil in
  (i) intermittent kilns; or
  (ii) continuous grate-fired kilns, not being tunnel kilns; or
  (iii) any kiln in which a reducing atmosphere is essential; or

(*c*) salt glazing of any earthenware or clay material is carried on.

37. Lime Works

Works in which calcium carbonate or calcium-magnesium carbonate is burnt through the agency of coal or oil.

38. Sulphate Reduction Works

Works in which metallic sulphates are reduced to the corresponding sulphides by heating with carbonaceous matter.

39. Caustic Soda Works

Works in which:

(*a*) either concentrated solutions of caustic soda or fused caustic soda are produced in vessels heated by coal; or

(*b*) black liquor produced in the manufacture of paper is calcined in the recovery of caustic soda.

40. Chemical Incineration Works

Works for the destruction by burning of wastes produced in the course of organic chemical reactions which occur during the manufacture of materials for the fabrication of plastics and fibres, and works for the destruction by burning of chemical wastes containing combined chlorine, fluorine, nitrogen, phosphorus or sulphur.

41. Uranium Works

Works [not being works licensed under the Nuclear Installations [Licensing and Insurance] Act, 1959, and not being nuclear reactors or works involving the processing of irradiated fuel therefrom for the purpose of removing fission products] in which:

(*a*) any ore or concentrate or any material containing uranium or its compounds is treated for the production of uranium or its alloys or its compounds; or

(*b*) any volatile compounds of uranium are manufactured or used; or

(*c*) uranium or its compounds are manufactured, fashioned or fabricated by any dry process giving rise to dust or fume.

42. Beryllium Works

Works in which:

(*a*) any ore or concentrate or any materal containing beryllium or its compounds is treated for the production of beryllium or its alloys or its compounds; or,

(*b*) any material containing beryllium or its alloys or its compounds is treated, processed or fabricated in any manner giving rise to dust or fume.

43. Selenium Works

Works in which:

(*a*) any ore or concentrate or any material containing selenium or its compounds is treated for the production of selenium or its alloys or its compounds; or

(*b*) any material containing selenium or its alloys or its compounds other than as colouring matter is treated, processed or fabricated in any manner giving rise to dust or fume.

44. Phosphorus Works

Works in which:

(*a*) phosphorus is made; or

(*b*) yellow phosphorus is used in any chemical or metallurgical process.

45. Ammonia Works

Works in which ammonia is:

(*a*) made; or

(*b*) used in the ammonia-soda process; or

(*c*) used in the manufacture of carbonate, nitrate or phosphate of ammonia or urea or nitriles.

46. Hydrogen Cyanide Works

Works in which hydrogen cyanide is made or is used in any chemical manufacturing process.

47. Acetylene Works

Works in which acetylene is made and used in any chemical manufacturing process.

48. Amines Works

Works in which:

(*a*) any methylamine or any ethylamine is made; or

(*b*) any methylamine or any ethylamine is used in any chemical process.

49. Calcium Carbide Works

Works in which calcium carbide is made.

50. Aldehyde Works

Works in which formaldehyde, acetaldehyde or acrolein or the methyl, ethyl or propyl derivate of acrolein are made.

51. Anhydride Works

Works in which acetic, maleic or phthalic anhydrides or the corresponding acids are made.

52. Chromium Works

Works in which any chrome ore or concentrate is treated for the production therefrom of chromium compounds or chromium metal is made by dry process giving rise to fume.

53. Magnesium Works

Works in which magnesium or any compound of magnesium is made by dry processes giving rise to fume.

54. Cadmium Works

Works in which metallic cadmium is recovered or cadmium alloys are made or any compound of cadmium is made by dry processes giving rise to fume.

55. Manganese Works

Works in which manganese or its alloys or any compound of manganese is made by dry processes giving rise to fume.

56. Metal Recovery Works

Works in which metal is recovered from scrap cable by burning the insulation.

57. Petroleum Works

Works in which:

(*a*) crude petroleum is handled or stored; or

(*b*) crude petroleum is refined by any operation carried out at petroleum refineries to convert crude petroleum into saleable products; or

(*c*) any product of such refining is subjected to further refining; or

(*d*) natural gas is refined; or

(*e*) any product of any of the foregoing operations is used, except as a solvent, in any subsequent chemical manufacturing process, not being a chemical manufacturing process described in any other scheduled work; or

(*f*) used lubricating oil is prepared for re-use by any thermal process.

58. Acrylates Works

Works in which acrylates are:

(*a*) made; or

(*b*) purified; or

(*c*) made or purified and polymerised.

59. Di-isocyanates Works

Works in which di-isocyanates are made, or partly polymerised or used in the manufacture of expanded plastics.

60. Mineral Works

Works in which metallurgical slags or pulverised fuel ash, or minerals are subjected to any size reduction, grading or heating by processes giving rise to dust, including the subsequent handling of the products of any such process but not including works for the processing of coal, lime works, ceramic works or foundries except in so far as the process carried on is described in any other scheduled work.

61. Smelting Works

Works in which sulphide ores, including regulus, are calcined or smelted.

NOXIOUS OR OFFENSIVE GASES

Muriatic acid
Sulphuric acid and sulphuric anhydride
Sulphurous acid and sulphurous anhydride [except those arising solely from the combustion of coal]
Nitric acid and acid forming oxides of nitrogen
Chlorine and its acid compounds
Bromine and its acid compounds
Iodine and its acid compounds
Fluorine and its compounds
Arsenic and its compounds
Ammonia and its compounds
Cyanogen compounds
Pyridine
Bisulphide of carbon
Chloride of sulphur
Acetylene
Sulphuretted hydrogen
Volatile organic sulphur compounds
Fumes from benzene works
Fumes from cement works
Fumes from tar works
Fumes from paraffin oil works
Fumes from petroleum works
Fumes containing copper, lead, antimony, arsenic, zinc, aluminium, iron, silicon, calcium, or their compounds
Fumes containing chlorine or its compounds
Smoke, grit and dust
Fumes containing uranium, beryllium, cadmium, selenium, sodium, potassium or their compounds
Carbon monoxide
Acetic anhydride and acetic acid
Acrylates
Aldehydes
Amines
Di-isocyanates
Fumes containing chromium, magnesium, manganese, molybdenum, phosphorus, titanium, tungsten, vanadium or their compounds
Maleic anhydride, maleic acid and fumaric acid
Products containing hydrogen from the partial oxidation of hydrocarbons
Phthalic anhydride and phthalic acid
Picolines

7. ROAD TRAFFIC POLLUTION LAW

Reflecting a worldwide trend, over the last few years controls over emissions of gaseous pollutants from petrol-driven vehicles and the use of lead as an additive in petrol have been added to those which previously existed in the U.K. over diesel exhaust emissions. All these controls except those over the lead content of petrol, which are not yet included in Regulations, are implemented by the Motor Vehicles (Construction and Use) Regulations 1973.

For the purpose of limiting or reducing air pollution, the Control of Pollution Act, passed in July 1974 ,enables the Secretary of State to issue Regulations imposing requirements as to the composition and contents of any kind of fuel used in motor vehicles; no such Regulations have yet been issued but a Statutory Instrument prescribing the maximum lead content of petrol has been circulated for comment and is expected to be introduced in late 1975.

Diesel Engined Vehicles

A number of Regulations are relevant to diesel exhaust smoke. At the manufacturing stage, all vehicles must be so constructed that they emit no avoidable smoke or visible vapour, and other "construction" Regulations apply particularly to diesel engined vehicles. Each new diesel engine for use in a road vehicle must be of a type which has been certified to a British Standard (B.S. A.U.141a) which lays down maximum permissible smoke opacity values for exhaust gases produced over a wide range of engine conditions. Since 2nd February 1974, type approval to EEC Directive 72/306—Emission of Pollutants from Diesel Engines for use in vehicles—gives exemption from the requirement for BSI certification for smoke emissions.

Also, excess fuel devices ("chokes") on diesel engines must be so fitted that they cannot be used while vehicles are in motion, if their use could increase the engine's smoke out-put. Since 1968 the Regulations have required most commercial vehicles to be fitted by their manufacturers with a plate showing particulars of weights and other matters, and the figures on the plate must show that a minimum power/weight ratio has been met. In use, no vehicle may emit smoke, vapour, dust grit or other substances so as to endanger other road users, and engines must not be altered or adapted in a way which increases their smoke output.

Petrol Engined Vehicles

Except for small three-wheeled cars and some exempted models, all petrol engined cars and light commercial vehicles first used on or after 10th November 1973, and manufactured on or after 20th September 1973, must comply with the limits laid down for emissions of hydrocarbons and carbon monoxide in Regulation No. 15 of the United Nations' Economic Commission for Europe. Compliance with EEC Directive 70/220, which is the Common Market equivalent of Regulation 15, is also acceptable.

The actual tests prescribed by ECE Regulation 15 require that the car shall be tested on a chassis dynamometer by a cycle of conditions representing driving in a congested urban area after a cold start. The maximum permissible mass of CO and HCs are set out in a table relating them to the weight of the vehicle concerned.

A second test involves the measurement of the percentage of carbon monoxide at idling speed with a hot engine. The volume of CO content of the exhaust gases must not exceed 4.5%.

Compliance with this Regulation must be attested by an approval mark, legibly and indelibly affixed to the vehicle. Reductions of up to 30% in carbon monoxide and up to 35% in hydrocarbons, compared to an uncontrolled vehicle, result from these requirements. Further reductions of 20% for CO and 15% for the HC emission limits are to be introduced and will affect vehicles used on or after the 1st April 1977 and not manufactured before 1st October 1976. Proposals to limit the emission of oxides of nitrogen (NOx) have been agreed and these form the basis of an amendment to Regulation 15 which is awaiting ratification.

In 1972 the Secretary of State for the Environment announced a programme of phased reductions in the permissible lead content of petrol. From a level of .84 grammes per litre in 1972, in November 1974 the permitted content was reduced to .55 grammes per litre. This was achieved by voluntary agreement between Government and the oil industry. But, as previously stated, is to be covered by legislation later this year.

Policy for Anti-Pollution Legislation on Motor Vehicles

So far, research has not shown that current levels of emission from motor vehicles offer any threat to health, although pollutants such as lead and carbon monoxide are undesirable since they are toxic in high concentrations, and their effects must be closely monitored. Current legislation will prevent total emissions from motor vehicles from rising significantly above present levels as vehicle population and total fuel usage increase. Criteria studies are being carried out in EEC and elsewhere to assess the levels of pollutants which can be tolerated and the need for emission controls. Meanwhile research continues and further measures will be taken when the need for them is established.

THE BRITISH STANDARD RINGELMANN CHART AND THE BRITISH STANDARD MINIATURE SMOKE CHART

The method of visual assessment of smoke emission by comparison of the darkness of the smoke with the standard shades of grey on a chart placed in a suitable position was devised by Professor Ringelmann of Paris towards the end of the 19th century. Professor Ringelmann obtained the shades of grey by cross-hatching in black on a white background so that a known percentage of the white was obscured.

The British Standard Ringelmann Chart (B.S.2742C) see figure 1, is printed for the British Standard Institution so that the shades obtained in use are both consistent and near the average to those which users were accustomed when using the previously available commercially-printed Ringelmann Charts, including those issued by the U.S. Bureau of Mines.

The Chart consists of a cardboard sheet 581 mm × 127 mm on which are printed five 101 mm (4") squares, four of which are cross-hatched by 20 horizontal and 20 vertical lines so that in use the cross-hatched black lines merge into the white background and produce for each shade, apparently, a uniform grey. For an average observer, the Chart must be placed more than 15 metres distant to produce the uniform shade.

The numbers of the shades—the Ringelmann numbers—range from 0 to 5; each shade increasing by comparison with the previous number by 20% obscuration so that

Ringelmann 1 = 20% obscuration
Ringelmann 2 = 40% obscuration
Ringelmann 3 = 60% obscuration
Ringelmann 4 = 80% obscuration

Ringelmann 5 (100% obscuration) is not reproduced on BS.2742C, and the black strip is included only for control during printing.

"Dark smoke" is smoke which is as dark as or darker than shade 2 on the Chart.

"Black smoke" is smoke which is as dark as or darker than shade 4 on the Chart.

The Use of the Ringelmann Chart.

The use of the Ringelmann and Miniature Smoke Charts (see below) is described in BS.2742:1969.

The Ringelmann Chart should be firmly mounted onto a backing holder—aluminium is suitable—similar to that described in BS.2742. Protective coverings must *not* be applied to the Chart in use and nothing should impair the luminance of its working surface.

It should be used under daylight conditions and held in a vertical plane in line between the observer and the chimney top, at a distance of more than 15 metres to ensure the cross-hatched lines merge into shades of grey.

A half-tone reproduction of the Miniature Smoke Chart

Where possible the general illumination of the sky should be uniform, but if the sun is shining or the sky bright on one side, the British Standard recommends that the bright source of illumination should be approximately at right angles to the line of vision and not in front of or behind the observer. Under hazy conditions observations should not be taken at extreme distance as there will be a tendency for the readings to be low. The angle of view of the Chart and smoke should be as low as possible; observations at a steep angle should be avoided.

The darkness of the smoke at the chimney terminal should be compared with the Chart; the Ringelmann number which most closely matches the darkness of the smoke, and the time and duration of the emission should be noted. In favourable conditions it is possible to estimate smoke darkness to the nearest quarter Ringelmann.

The Miniature Smoke Chart (*BS.*2742*M*)

Because of the situations in which the British Standard Ringelmann Chart cannot be used, the British Standards Institution has developed the Miniature Smoke Chart.

The Miniature Smoke Chart is a small card 129 mm × 69 mm on which are printed shades of grey so that in use the shades correspond to the shades of the BS. Ringelmann Chart produced by the merging cross-hatching. The Standard indicates that, at this stage, the Miniature Smoke Chart is not intended for use as a substitute for the Ringelmann Chart; but in practice with an experienced observer the results obtained by use of either Chart are identical.

Since the Chart is slightly translucent, it should be backed with white opaque material or placed in a holder.

The Standard recommends that the Chart should be held at a distance of 1.5 metres from the eye in a holder on the end of a light rod; but also indicates that it can be held at arm's length—with some reservation on the accuracy of the readings obtained.

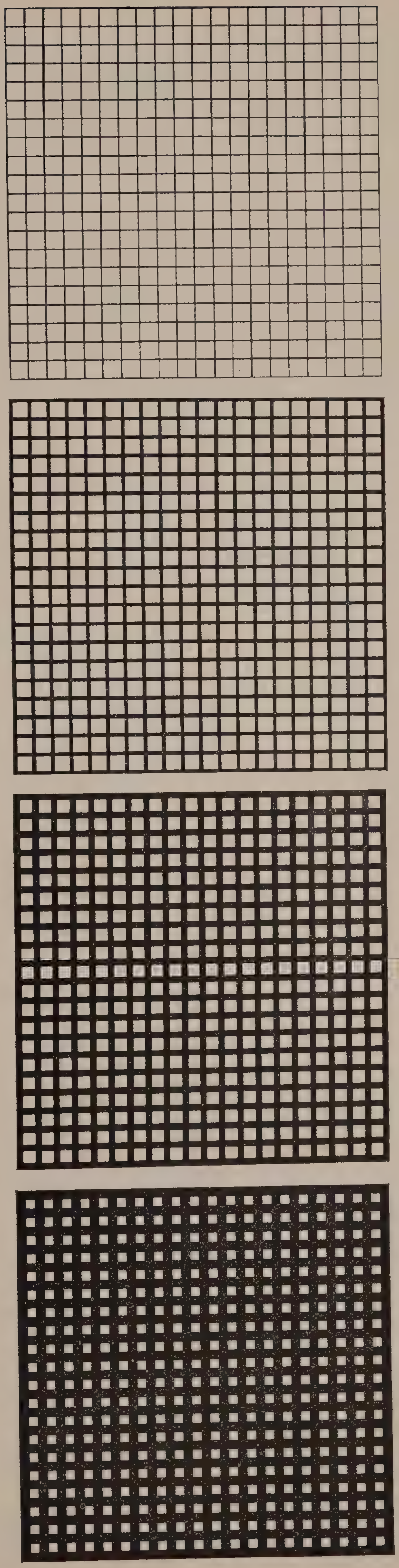
In other respects—lighting, angle of view, etc.—the Miniature Smoke Chart should be used similarly to the British Standard Ringelmann Chart.

The Microringelmann Chart.

This is a card 127 mm × 84 mm on which are printed an accurate photographic reduction of the cross-hatched Ringelmann shades 1 to 4, above and below a horizontal slot through which the chimney top is viewed. The lines almost merge to a shade when, in use, the Chart is held at arm's length.

The recommended method of use is different from that of the British Standard Charts in that with the Microringelmann the sun should be behind the observer.

The Chart is printed with a reflective surface and great care is required to obtain an accurate assessment of smoke colour. Some experienced observers consider that the use of the Microringelmann Chart should not now be recommended because of this difficulty.



No. 1

No. 2

No. 3

No. 4

A photographic reproduction of the chart

SMOKE CONTROL AREAS

Programmes and Progress

The following lists contain the names of the new local authority areas as of April 1st 1974. Due to the local government reorganization in certain parts of the country, figures will differ markedly from previous years, and many 'TARGET DATES FOR PROGRAMME COMPLETION' and 'FINAL ACREAGE WHEN COMPLETED' figures have not yet been decided, due to this major structural change.

There is no longer a differentiation between 'black' and 'white' areas. The figures have been compiled directly from information obtained from the local authority concerned.

The figures are for the position on 30 June 1975 and some authorities' figures will have changed since this date.

An asterisk with bold type indicates completed programmes. The new British Isles divisions, issued by the Department of the Environment are listed below.

DEPARTMENT OF THE ENVIRONMENT DIVISIONS

NORTHERN	Cleveland, Cumbria, Durham, Northumberland, Tyne and Wear.
NORTH WEST	Cheshire, Greater Manchester, Lancashire, Merseyside.
YORKSHIRE & HUMBERSIDE	Humberside, North Yorkshire, South Yorkshire, West Yorkshire.
WEST MIDLANDS	Hereford and Worcester, Salop, Staffordshire, Warwickshire, West Midlands.
EAST MIDLANDS	Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire.
EAST ANGLIA	Cambridgeshire, Norfolk, Suffolk.
GREATER LONDON	
SOUTH EAST	Bedfordshire, Berkshire, Buckinghamshire, East Sussex, Essex, Hampshire, Hertfordshire, Kent, Oxfordshire, Surrey, West Sussex.
SOUTH WEST	Avon, Cornwall, Devon, Dorset, Gloucestershire, Somerset, Wiltshire.
WALES	Clwyd, Dyfed, Gwent, Gwynedd, Mid Glamorgan, Powys, South Glamorgan, West Glamorgan.
SCOTLAND	
NORTHERN IRELAND	

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
NORTHERN				
Allerdale DC (Cumbria)	1982	5,644	1,064	1,173
Blyth Valley DC (Northumberland)	1985	17,649	2,012	5,365
Carlisle City (Cumbria)	—	6,092	—	—
Castle Morpeth BC (Northumberland)	1983	2,173	—	—
Darlington (B) (Co. Durham)	1983	49,375	2,136	7,934
Durham City (Co. Durham)	—	44,000	—	—
Easington DC (Co. Durham)	1979	1,440	840	4,192
Gateshead (MB) (Tyne & Wear)	1980+	35,372·36	6,655	31,186
Hartlepool (B) (Cleveland)	1979	12,000	5,747	21,658
Langbaurgh (B) (Cleveland)	1980	30,513	7,970	17,101
Middlesbrough (B) (Cleveland)	1979	11,400	9,933	42,829
Newcastle-upon-Tyne (M) (Tyne & Wear)	1977	28,414	10,797	68,999
North Tyneside (MB) (Tyne & Wear)	1981	21,000	8,190	35,250
South Lakeland (DC) (Cumbria)	—	383,000	—	—
South Tyneside (MB) (Tyne & Wear)	1981	15,604	12,063·76	41,675
Stockton-on-Tees (B) (Cleveland)	—	39,300	21,623	29,161
Sunderland (MB) (Tyne & Wear)	—	34,530	3,821·8	19,200
NORTH WESTERN				
Blackburn DC (Lancs)	—	32,000	7,476	31,484
Bolton (MB) (Gtr. Manchester)	1981	34,000	13,160	49,976
Burnley (B) (Lancs.)	1977/8	33,088	7,273	34,355
Bury (MB) (Gtr. Manchester)	1982	24,506	15,919	44,989
Ellesmere Port (B) (Cheshire)	1977	4,000	3,608	14,576
Halton BC (Cheshire)	1977	12,985	9,942	32,550
Hyndburn (B) (Lancs.)	1981	18,050	6,830	18,987

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Knowsley (M) (Merseyside)	Programme deferred		6,359	51,243
Lancaster City (Lancs.)	—	130,000	5,086·8	7,926
Liverpool (M) (Merseyside)	—	27,819	19,089	107,057
Macclesfield (B) (Cheshire)	1986+	130,000	304·35	2,653
Manchester City (M) (Gtr. Manchester)	1977	28,720	20,981	131,790
Oldham (M) (Gtr. Manchester)	Suspended	34,854	13,882	66,435
Pendle DC (Lancs)	1979	—	6,136	31,244
Preston (B) (Lancs)	1979	35,188	4,739	26,641
Ribble Valley (B) (Lancs)	1983/4	75,000 approx.	432	356
Rochdale (M) (Gtr. Manchester)	1980	39,306	17,923	52,440
Rossendale (B) (Lancs)	1980-90	34,170	1,761·33	3,317
St. Helens (MB) (Merseyside)	1981	32,201	8,632·16	25,613
Salford City (M) (Gtr. Manchester)	No figures received from L.A.			
Sefton (M) (Merseyside)	Not known	36,388	2,587	13,463
South Ribble (B) (Lancs)	1985	27,454	946	2,220
Stockport (MB) (Gtr Manchester)	1980	31,147	18,554	69,100
Tameside (MB) (Gtr. Manchester)	1980	25,519	17,110	71,276
Trafford (MB) (Gtr. Manchester)	1978	15,771	13,075	78,054
Vale Royal DC (Cheshire)	—	6,588	6,588	9,868
Warrington (B) (Cheshire)	1980	43,527	29,884	48,754
West Lancashire DC	1984	80,709	3,369	10,044
Wigan (MB) (Gtr. Manchester)	1985	52,918	14,838	41,888
Wirral (M) (Merseyside)	1981	32,176	15,659	75,970

YORKSHIRE AND HUMBERSIDE

Barnsley (MB) (S. Yorks)	1985	81,243	6,819	14,138
Bradford City (M) (W. Yorks)	1978	91,444	50,838	180,106
Calderdale (MB) (W. Yorks)	1980	89,890	37,713	60,684
Craven DC (N. Yorks)	1980	19,529	4,079	5,817
Derwentside DC (Co. Durham)	—	—	639	2,726
Doncaster (MB) (S. Yorks)	—	139,000	13,487	28,820
Glanford DC (Humberside)	—	144,738	15,263	489
Harrogate DC (N. Yorks)	—	320,000	2,003	5,220
Kingston-upon-Hull (CBC) (Humberside)	—	17,599	8,476·6	48,798
Kirklees (MB) (W. Yorks)	1990	102,400	27,413	80,614
Leeds City (M) (W. Yorks)	1980	134,916	62,782	186,899
Rotherham (M) (S. Yorks)	—	69,881	6,762	25,644
Scunthorpe (B) (Humberside)	1978	7,895	3,926	18,061
Sheffield City (M) (S. Yorks)	—	—	45,363	189,000
Wakefield City (M) (W. Yorks)	1990	83,880	14,297	33,022
York City (N. Yorks)	1982/83	7,295	4,600	9,285

WEST MIDLANDS

Birmingham City (W. Midlands)	1978	65,309	41,426	247,497
Cannock Chase DC (Staffs)	New programme not yet decided			
Coventry City (M) (W. Midlands)	1982/3	23,425·38	6,906	28,859
Dudley (MB) (W. Midlands)	1984	24,165	16,540	64,880
East Staffordshire DC (Staffs)	—	4,222	1,675	5,700
Lichfield DC (Staffs)	1978+	3,597	581	138
Newcastle-under-Lyme (B) (Staffs)	—	52,169	4,099	13,903
North Warwickshire (B) (Warwicks)	1983	24,891	245	1,330
Nuneaton (B) (Warwicks)	1982	19,587	6,635	12,100
Rugby (B) (Warwicks)	1984	7,010	3,867·1	10,761
Sandwell (MB) (W. Midlands)	—	21,150	6,034	30,378
Shrewsbury & Atcham (B)	—	148,928	379	2,494
Solihull (MB) (W. Midlands)	1980's	44,495	6,167	34,856
South Staffordshire DC (Staffs)	1986	10,000	4,186	954
Stafford (B) (Staffs)	1983	120,000	—	—
Staffordshire Moorlands DC (Staffs)	—	—	96	479
Stoke-on-Trent City (Staffs)	1986	22,949	11,302	37,239
Tamworth (B) (Staffs)	1980	7,647	3,563	6,574
Walsall (MB) (W. Midlands)	1980	69,792	2,180	8,479
Warwick DC (Warwicks)	1984	69,791	2,180	8,479
Wolverhampton (MB) (W. Midlands)	1986	17,004	5,863	40,558
Worcester City (Hereford & Worcs)	1985	7,876	—	—
Wrekin DC (Salop)	1994	72,000	724·7	2,555

EAST MIDLANDS

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Amber Valley DC (Derby)	—	—	2,605	4,772
Ashfield DC (Notts)	—	27,520	9,644	13,132
Bassetlaw DC (Notts)	1981	20,533	1,373	1,232
Blaby DC (Leics)	1986	32,212	2,057	6,047
Bolsover DC (Derby)	—	39,623	890	2,806
Broxtowe DC (Notts)	1982	14,667	6,468	24,183
Chesterfield (B) (Derby)	1981	16,265	3,433	11,620
Corby DC (N'hants)	1982	3,703	1,136	8,642
Derby (B) (Derby)	1979	19,282	12,834	44,272
Erewash (B) (Derby)	—	26,955	1,584·59	6,238
Gedling (B) (Notts)	1986	27,761	2,651·97	12,183
High Peak DC (Derby)	1979	9,661	2,084·76	7,200
Hinckley & Bosworth (B) (Leics)	—	73,537	—	—
Kettering (B) (N'hants)	—	57,737	—	—
Leicester City (Leics)	1975	17,231	15,635	112,281
Lincoln City (Lincs)	—	8,828	3,990	6,031
Mansfield DC (Notts)	1990	18,997	5,729	13,798
Northampton (B) (N'hants)	1996	19,181	6,383	11,464
North East Derbyshire DC (Derby)	1986	68,101	18,257	20,170
Nottingham City (Notts)	1985	18,364·121	7,975	30,285
Oadby and Wigston (B) (Leics)	Suspended	5,864	130	888
Rushcliffe (B) (Notts)	Suspended	3,044·8	1,778·8	4,694
South Derbyshire DC (Derby)	—	18,701	1,487	2,250
South Kesteven DC (Lincs)	—	—	1,544·5	4,551

EAST ANGLIA

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Cambridge City (Cambs)	—	10,060	1,435	1,066
Norwich City (Norfolk)	—	9,665	1,435	1,066
Peterborough City (Cambs)	—	82,424	2,929	4,757
West Norfolk DC (Norfolk)	—	—	841	4,377

SOUTH WEST

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Bath City (Avon)	1990	7,000	—	—
Bristol City (Avon)	1980/84	27,000	8,151	34,805
Cheltenham DC (Gloucs)	—	—	861·25	2,599
Exeter City (Devon)	1984	10,952	5,643	12,515
North Wiltshire DC (Wilts)	After 1985	14,124	—	—

SOUTH EAST

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Aylesbury Vale DC (Bucks) (Town only)	1981+	3,594	912·5	4,930
Basildon DC (Essex)	1979	—	4,528	21,682
Bedford DC (Beds)	1985	6,274	2,977	8,267
Bracknell DC (Berks)	1985	8,636	2,971	10,668
Brentwood DC (Essex)	—	—	227	2,856
Brighton (B) (E. Sussex)	1990	14,613	550	2,975
Broxbourne (B) (Herts)	1987	12,903	1,951	8,579
Canterbury City (Kent)	—	77,207	217	1,556
Crawley (B) (W. Sussex)	1980	9,013	5,622	28,500
Dacorum DC (Herts)	—	—	3,517	13,470
Dartford DC (Kent)	1980	17,267	4,207	15,677
Epping Forest DC (Essex)	—	—	600·2	1,866
Epsom & Ewell (B)	—	8,427	—	—
Fareham (B) (Hants)	—	18,352	—	—
Gillingham (B) (Kent)	1978	11,123	9,204	23,754
Gravesham (B) (Kent)	1981	4,500	2,003	8,553
Guildford (B) (Surrey)	1984	approx. 7,300	200	942
***Harlow DC (Essex)**	**1964**	**6,313**	**6,313**	**23,556**
Hertsmere DC (Herts)	—	21,031	2,121	7,913
Luton (B) (Beds)	1980	10,695	5,451	30,508
Medway (B) (Kent)	—	—	6,383	19,974
Milton Keynes (B) (Bucks) (Bletchley only)	1979	—	1,260	7,500
North Hertfordshire DC (Herts)	—	92,211	1,341	4,450
Oxford City (Oxfordshire)	1985	8,785	2,920	14,503
Portsmouth City (Hants)	1988	9,249	43·45	1,257
Reading (B) (Berks)	1985	9,106	4,709	21,530
Sevenoaks DC (Kent)	—	91,586	1,341	3,684
Slough (B) (Berks)	—	6,810	3,886	20,881

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Southampton City (Hants)	1985	12,058	2,795	18,641
Spelthorne (B) (Surrey)	1977+	13,880	8,271	19,500
Stevenage (B) (Herts)	1978/79	6,256	1,515·7	5,150
Three Rivers DC (Herts)	—	21,630	—	—
Thurrock (B) (Essex)	1985	40,000	5,800	15,704
Watford (B) (Herts)	1978	5,275	2,870	12,700
Windsor & Maidenhead (Berks) Royal Borough	—	831	831	2,655
Wokingham DC (Berks)	—	44,214	—	—
Wycombe DC (Berks)	1984	5,948	3,818·6	16,422

GREATER LONDON

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
***Corporation of London**	**1955**	**678**	**678**	**17,147**
Barking	1978	8,877	5,947·7	46,497
Barnet	1978	22,123	15,282	107,468
Bexley	1976	15,896	13,457	78,707
***Brent**	**1975**	**10,934**	**10,934**	**95,624**
Bromley	1978	37,583	18,608	96,926
***Camden**	**1968**	**5,364**	**5,364**	**87,303**
Croydon	Suspended	21,395	13,164	98,246
***Ealing**	**1972**	**13,708**	**13,708**	**91,057**
Enfield	1976	21,000	19,442	84,589
***Greenwich**	**1972**	**11,724**	**11,724**	**75,673**
***Hackney**	**1967**	**4,814**	**4,814**	**90,507**
***Hammersmith**	**1967**	**3,950**	**3,950**	**72,559**
***Haringey**	**1968**	**7,491**	**7,491**	**90,575**
Harrow	1975	12,555	10,993	76,373
Havering	1977/8	29,650	21,954	66,230
Hillingdon	1978	27,258	18,210	72,421
***Hounslow**	**1972**	**14,469**	**14,469**	**73,646**
***Islington**	**1969**	**3,679**	**3,679**	**82,000**
***Kensington & Chelsea (Royal)**	**1972**	**2,950**	**2,950**	**25,288**
Kingston-upon-Thames (Royal)	1977	9,821	5,474	41,140
Lambeth	1976	6,727	4,947·31	86,671
Lewisham	1978+	8,579	8,185	105,024
Merton	1975	9,381	8,669	58,904
Newham	1977	8,986	4,081	56,632
***Redbridge**	**1971**	**13,983**	**13,983**	**67,658**
***Richmond-upon-Thames**	**1972**	**13,873**	**13,873**	**75,400**
Southwark	1976	6,981	5,399	85,075
Sutton	1976	10,732	10,462	68,882
***Tower Hamlets**	**1968**	**4,876**	**4,876**	**42,440**
Waltham Forest	1978	9,805	8,462·9	74,152
Wandsworth	1976	8,892	7,942	92,343
***Westminster (City)**	**1970**	**5,334**	**5,334**	**13,021**

NORTHERN IRELAND

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Antrim (Co. Antrim)	1976	740	710	4,344
Ards (B)	—	—	105·3	823
Armagh	1980	2,400	579	2,984
Ballymena (B)	Programme deferred indefinitely	157,310	325	890
Belfast City	1989	26,218	2,274	15,492
Castlereagh DC	1979	5,142	3,165	13,188
Craigavon (B)	1980	5,976	4,499	6,949
Down (Co. Down)	—	—	482	639
Larne (B) (Co. Antrim)	1976	2,381	11	290
Londonderry City	—	—	74	546
Newtownabbey	—	—	1,489	4,124
North Down (B)	—	—	176	765
***Strabane**	**1974**	**54**	**54**	**750**

SCOTLAND

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
***Bearsden and Milngavie (Strathclyde)**	**—**	**5,000**	**5,000**	**13,000**
Clackmannan (Central)	1976	1,807	642·40	2,947
Clydebank (Strathclyde)	1975	4,060	3,213·37	16,795
Cumbernauld & Kilsyth (Strathclyde)	—	25,342	768	2,107
Dumbarton (Strathclyde)	—	—	2,614·28	7,970
Dundee City (Tayside)	1980	12,855	8,448	50,714
Dunfermline (Fife)	1985	75,265	718·34	2,107
East Kilbride (Strathclyde)	1980	7,158	6,658	21,810
Edinburgh City (Lothian)	1982	34,781	12,249	49,586

	Target Date	*Final Acreage*	*Acreage (In Oper.)*	*Premises (In Oper.)*
Ettrick & Lauderdale (Borders)	—	336,000	1,767	5,067
Falkirk (Central)	—	71,680	11,010·85	30,028
Glasgow City (Strathclyde)	1980	52,252	31,268	214,382
Hamilton (Strathclyde)	—	42,883	2,010·40	8,554
Inverclyde (Strathclyde)	—	34,000	1,461	7,401
Kilmarnock and Loudoun (Strathclyde)	—	**100·9**	**100·9**	**577**
Kirkaldy (Fife)	—	—	5,839·01	7,083
Midlothian County	No figures received from L.A.			
Monklands (Strathclyde)	1987	8,648	4,615	17,733
Motherwell (Strathclyde)	1990	37,455	733·33	3,364
Nithsdale (Dumfries & Galloway)	1985	2,862	728	1,000
Renfrew (Strathclyde)	1980	—	12,091	53,300
Roxburgh (Borders)	—	—	—	—
Roxburgh (DC)	1982	1,240	392·07	1,868
Stirling (Central)	—	—	199	2,004
Strathkelvin (Strathclyde)	—	40,960	2,322	—
WALES				
Alyn and Deeside (W)	—	—	50	427
Newport (B) (W) (Gwent)	—	—	53·1	901
Wrexham Maelor (B) (W)	—	90,571	2,059	8,825

SMOKE CONTROL AREAS

Progress Report
Position at 30th June 1975

(Figures supplied by the Department of the Environment, The Welsh Office, The Northern Ireland Ministry of Development and the Scottish Development Department).

** Corrected to comply with Scottish Development Department figures*

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 31.3.75	4,499			19			246*			63		
Acres		1,439,641			2,855			131,872*			15,583	
Premises			6,469,033			10,499			564,078*			42,081
Smoke Control Orders Confirmed (31.3.75-30.6.75)	41			1			—			1		
Acres		21,980			13			—			—	
Premises			70,244			—			—			130
Totals	**4,540**	**1,461,621**	**6,539,277**	**20**	**2,868**	**10,499**	**246**	**131,872**	**564,078**	**64**	**15,583**	**42,211**
Smoke Control Orders Submitted (31.3.75-30.6.75)	25			2			2			—		
Acres		12,001			25			2,048			—	
Premises			37,292			81			4,557			—
Grand Totals	**4,565**	**1,473,622**	**6,576,569**	**22**	**2,893**	**10,580**	**248**	**133,920**	**568,635**	**64**	**15,583**	**42,211**
Smokeless Zones (Local Acts) in Operation ..	44			—			—			—		
Acres		3,400			—			—			—	
Premises			41,060			—			—			—

The History of Air Pollution and its Control in Great Britain

852 First records of the use of coal in England.

1228 Record of "Sacoles Lane" (sea-coals) in London.

1257 Eleanor, Queen of Henry III, left Nottingham for Tutbury on account of the smoke nuisance.

1273 Use of coal prohibited in London as being "prejudicial to health".

1306 Royal Proclamation prohibiting artificers from using sea-coal in their furnaces. Record of the execution of one offender.

1307 Commission of Inquiry appointed to "inquire of all such who burnt sea-coal in the city or parts adjoining, and to punish them for the first offence with great fines and ransoms, and upon the second offence to demolish their furnaces".

1563 Scarcity of wood fuel led to an Act prohibiting the export of wood. Consequent expansion of the coal trade.

1578 Queen Elizabeth I "findeth hersealfe greately greved and annoyed with the taste and smoke of the sea-cooles". Westminster brewers offered to burn wood because of her objection to coal smoke. Elizabeth, James I and Charles I all imposed export duties on coal.

1595 Thomas Owen brought Welsh coal and anthracite to London to demonstrate its smokelessness.

XVI century (Elizabeth's reign). Prohibition of coal in London whilst Parliament was sitting.

1603 Sir Hugh Platt's smokeless briquettes.

1648 Petition of Londoners to Parliament to prohibit the importation of coal from Newcastle on account of the injury they experienced.

1661 John Evelyn submitted his "Fumifugium, or the Smoake of London Dissipated", to Charles II.

1700 Publication of "Campania Foelix", with a "Discourse on the Fuel of London", by Timothy Nourse,—mentioned the "stink" of coal.

Circ. **1799** Benjamin Thompson's smokeless grates.

1801 Manchester Corporation Nuisance Committee on "Smoake".

1819 Committee appointed by Parliament to inquire how far persons using steam engines and furnaces could erect them in a manner less prejudicial to public health and comfort.

1843 A Select Committee recommended the introduction of a Bill dealing with nuisances from furnaces and steam engines.

1845 Another Select Committee reported that it was not desirable to extend the provisions of an Act beyond furnaces used for steam generation.

1845 Manchester cotton mill was observed to emit black smoke for 8 hrs. 52 mins. out of 9 hrs.

1845 Railway Clauses Consolidated Act requiring engines to consume their own smoke.

1847 The Town Improvement Clauses Act contained a section dealing with factory smoke.

1850 Manchester Smoke Inspector's Report—over 500 factory premises inspected—300 notices or cautions issued.

1853-6 Smoke Abatement Acts relating to the Metropolitan area.

1863 Alkali, etc. Works Regulation Act.

1866 The Sanitary Act empowered sanitary authorities to take action in cases of smoke nuisances.

1875 The Public Health Act containing a smoke abatement section on which legislation to the present day has been based.

1881 Formation of a Smoke Abatement Committee as a result of a movement started by the Kyrle Society and the Public Health Society.

1881 Smoke Abatement Exhibition at South Kensington organized by the Public Health and Kyrle Societies.

1882 Formation of the National Smoke Abatement Institution.

1882 Manchester Noxious Vapours Association held an exhibition.

1887 Failure of the Smoke Abatement (Metropolis) Bill in the House of Lords.

1891 The Public Health (London) Act.

1899 Formation of the Coal Smoke Abatement Society, led by Sir William Richmond, R.A., and Dr. H. A. Des Vœux (concerned mainly with London).

1903 Birmingham had four smoke inspectors.

1904 London County Council published a comprehensive report on the London smoke problem.

1905 The Government published a report on laws regarding smoke in other countries.

1905 Leeds appointed a full time smoke inspector. About this time the London Coal Smoke Abatement Society appointed smoke inspectors, but found little official support.

1906 The Alkali, etc. Works Regulation Act, which extended and consolidated previous similar Acts.

1909 Sheffield Smoke Abatement Exhibition, at which was set up the Smoke Abatement League of Great Britain (mainly for the provinces and centred later in Manchester and Glasgow).

1912 International Smoke Abatement Exhibition in London, organized by the Coal Smoke Abatement Society, leading to the formation of a Committee for the Investigation of Atmospheric Pollution.

1913 Smoke Abatement Bill introduced in the House of Commons by A. G. C. Harvey, M.P.

1914 Smoke Abatement Bill introduced in the House of Lords by Lord Newton. Withdrawn on the appointment of a Departmental Committee to investigate the problem.

1920 Committee re-formed after the war with Lord Newton as Chairman — they issued an Interim Report—dealing largely with domestic smoke.

1921 Publication of the Final Report of the Newton Committee.

1926 Public Health (Smoke Abatement) Act by which the 1875 and 1891 Acts were amended and extended.

1927 Establishment of first regional committees of local authorities.

1929	Amalgamation of the Coal Smoke Abatement Society and Smoke Abatement League of Great Britain to form the National Smoke Abatement Society. First publication of a journal (*Clean Air*) devoted to air pollution.
1935	First records of completely smokeless housing estates.
1936	Public Health Act, in which were included the provisions of the Smoke Abatement Act of 1926.
1946	Simon Report on Domestic Fuel Policy, recommending, *inter alia*, measures for domestic smoke prevention.
1946	First smokeless zone and prior approval legislation (Manchester Corporation Act).
1951	First smokeless zone established (in Coventry).
1952	Ridley Report on "Policy for the Use of Fuel and Power Resources", recommending, *inter alia*, measures for smoke prevention.
1952	London smog disaster, the most serious for many years, with a death roll of 4,000 (*q.v.*).
1953	Beaver Committee on Air Pollution was set up by the Government and published an Interim Report.
1954	Final Report of the Beaver Committee.
1954	A Clean Air Bill introduced by Gerald Nabarro, M.P., and withdrawn (4 February 1955) on Government undertaking to introduce their own Bill.
1955	Whole of City of London declared a smokeless zone.
1956	Clean Air Act.
1958	National Smoke Abatement Society became incorporated under new name of National Society for Clean Air.
1959	International Diamond Jubilee Clean Air Conference and Exhibition (N.S.C.A.), London.
1962	Smog episode in London and other cities. Estimated death roll of 750 in Greater London.
1962	Holborn M.B. first local authority in country to reach its final target under Clean Air Act.
1964	Amendments to Clean Air Act in Housing Act, 1964, modifying smoke control area policy. Clean Air Act (Northern Ireland).
1966	First Congress of the new International Union of Air Pollution Prevention Associations (in London).
1966	Alkali, etc. Works Order revoked all earlier seven Orders and consolidated them, making a few minor alterations to the lists of scheduled works and noxious or offensive gases.
1968	Clean Air Act passed.
1969	Clean Air Act brought into operation.
1970	Second Congress of the International Union of Air Pollution Prevention Associations (in Washington).
1971	The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations and the Clean Air (Emission of Grit and Dust from Furnaces) Regulations.
1971	The Alkali & C. Works Order.
1971	The Royal Commission on Environmental Pollution.
1972	U.N. Conference on the Human Environment, Stockholm.
1973	Motor Vehicles (Construction and Use) Regulations 1973
1973	Third Congress of International Union of Air Pollution Prevention Associations (in Dusseldorf).
1974	Control of Pollution Act passed.
1974	Health and Safety at Work Act passed.
1974	Distinction between "black" and "white" areas for smoke control abolished.
1974	Royal Commission on Environmental Pollution undertook a study to review the efficacy of the methods of control of air pollution and to consider the relationship between the various authorities.
1975	Repeal of the Alkali Act and replacement by regulations under Health and Safety at Work Act.

Major Smog Disasters

The word "smog" was first used by the late Dr. H. A. Des Vœux, founder, president of the N.S.A.S. in 1905, to denote the combination of smoke and natural fog that in urban areas may have disastrous consequences. There are numerous cases of smog conditions resulting in a marked rise in mortality and morbidity from respiratory disorders and consequential cardiac failure. Among these incidents are the following:

London, 1873. Rise in bronchitis deaths, compared with the previous week, of 268.

London, 1880. Rise in bronchitis deaths, compared with the previous week, of 692.

London, 1891. Rise in bronchitis deaths, compared with the previous week, of 572.

Glasgow, 1909. Average number of deaths in the three weeks prior to the fog were 57 per week. During five weeks of fog or haze the deaths per week were: 138, 233, 171, 198 and 137.

Manchester and Salford, 1930-31. In December, with no fog, there were 137 respiratory disease deaths. In January there were nine days heavy fog and 592 deaths.

Meuse Valley, 1930. 60 deaths attributed to fog, the death rate rising to 10·5 times the normal. Many cattle had to be slaughtered.

London, 1948. Bronchitis deaths in week before fog, 73; in the week of fog, 148.

Donora, U.S.A., 1948. 18 deaths in a population of 14,000. 42 per cent of the population were estimated to have suffered from illness.

London, 1952. The fog developed on Friday, 5 December and continued until 8 December. Estimated total of 4,000 deaths in the Greater London area. In the Administrative County only deaths from bronchitis rose from 121 to 872, and from heart and circulatory diseases, from 318 to 801.

London, 1956. 1,000 additional deaths attributed to January fog in the Greater London area. (*B.M.J.*, 31 March, 1956.)

London, 1962. Fog in London and other areas, December 3-7, with similarities to the 1952 fog, but with 750 additional deaths as compared with 4,000.

Principal References

Mortality and Morbidity during the London Fog of December, 1952. Ministry of Health Public Health Report No. 95. (This report contains a section on "Previous Fog Incidents", with a statistical appendix for those in London.)

Les Problèmes de Pollution de l'Atmosphère, Batta, Firket and Leclerc, Liége, 1937.

Air Pollution in Donora, Pa. Public Health Bulletin, No. 306, Federal Security Agency, Public Health Service, Washington.

The Clean Air Case

A Synopsis for the Guidance of Speakers, Writers, Teachers, etc.

1. Historical Background. Growth of the air pollution problem and efforts to abate it, from 852 to the present day. *(See History of Air Pollution and Its Control.)*

2. Perspective and Proportion.

(a) It is important that man-made pollution of the air is kept in perspective. Nature—e.g. volcanoes, sandstorms, pollen—can also pollute the air. *(See film strip "The Air You Breathe" and booklet "Pollution".)*

(b) Air pollution should not be considered in isolation. Pollution of the air can pollute water. Incineration of rubbish, if not properly controlled, can pollute the air.

3. Nature, Sources and Causes.

(a) Combustive Sources.

Smoke: Due to incomplete combustion; consists of fine carbonaceous particles and tarry droplets. Most smoke still from domestic sources—the open fire burning bituminous coal. There is smoke from industry, of course, but with the use of modern appliances and furnaces, this is now better controlled. *(For quantities produced, see "Table of Estimates of Air Pollution".)*

Garden Bonfires.

Gases: Sulphur dioxide the most prevalent, also harmful in association with smoke particles. Carbon monoxide, and noxious gases and fumes from chemical processes. *(See "Sulphur Dioxide as an Air Pollutant" and Table of Estimates of Air Pollution.)*

Grit and Dust: Mainly from industrial sources, e.g., pulverised coal and highdraught furnaces.

(b) Non-combustive Sources.

Grit and dust from quarries, mineral crushing plants, cement works, etc.

4. Extent and Behaviour of Pollution. Measurement of floating and deposited impurities, sulphur dioxide, and of light values. The Investigation under the Warren Spring Laboratory. *(q.v.)*

5. Meteorology.

(a) The effects of climate and weather, prevailing and other winds, rainfall and wash out of pollutants causing changes *(See "Sulphur Dioxide as An Air Pollutant".)*

(b) Natural and smoke fogs, their formation and characteristics. The London, 1952, 1962 and other lethal smogs.

6. Effects.

(a) Health: Effects on respiratory system. Effects due to obstruction of natural light. Psychological and social consequences of life in smoke-ridden environment. Effects of smog are the result on infrequent high concentration of pollution, whereas the insidious action of "normal" pollution takes place continuously.

(b) Plant Life: Principal factors injurious to vegetation are: loss of sunlight, blocking of stomata by deposits, direct attack by chemicals, acidification of soil. Indirect effect on grazing animals through deterioration of herbage, or of poisoning in the case of fluoride pollution.

(c) Materials: Corrosion and erosion of metals, stone, fabrics, leather, etc.

(d) Visibility: Loss of visibility due to smoke haze and smog affecting air and surface transport.

(e) Costs: (See The Cost of Air Pollution.)

7. Prevention.

Industrial Smoke: Calls for correct equipment, maintenance and operation of plant. Value of mechanical stoking. Uses of oil, gas, electricity and smokeless solid fuel. Importance of training and certification of stokers. Instrumentation, smoke alarms, etc. Need for all-round fuel efficiency.

Dust and grit: Use of arrestors of appropriate types: cyclones, wet washing, electrostatic precipitators. *Sulphur:* removal by coal washing, flue-gas washing and other possible means. Importance of dispersion from high chimneys and emission velocity.

Domestic: By use of smokeless fuels—gas, electricity, oil or solid. Need for efficient appliances. Central and district heating, whole-house warming. Smoke control areas, purpose and national programme.

Railways and Roads: Use of diesels and electricity for the former. Need for efficient combustion and good maintenance in road vehicles. *(See also N.S.C.A. booklet "Air Pollution from Road Vehicles".)*

8. Policy, Law, etc.

The present law—Clean Air Acts, 1956 and 1968, Public Health Act, 1936, local Acts, Road Traffic Act, 1930, Alkali, etc., Works Regulation Act, 1960, and Orders, etc., the Motor Vehicles (Construction and Use) Regulations 1973, the Control of Pollution Act, 1974, and the Health and Safety at Work Act, 1974. Explanation of the Philosophy of "the best practicable means'. The Beaver Report and its proposals. Responsibilities of local authorities and central Government. Smokeless zones and smoke control areas. Work of the Warren Spring Laboratory, Alkali Inspectorate and other organisations. Educational and publicity work of the National Society for Clean Air. *(See Outline of the Law Relating to Air Pollution, see also the N.S.C.A. booklets "Notes on the background to Clean Air", "Towards Cleaner Air", and "Pollution", and film strip "The Air You Breathe".)*

9. Achievements.

Greater London now nearly all subject to smoke control. Overall reduction in smoke throughout the country; reduction in ground level concentrations of sulphur dioxide. The return of birds to cities; more varieties of flowers; cleaner buildings and less corrosion and erosion. Improved health of city dwellers in particular. *(See film strip "The Air You Breathe".)*

10. The Future.

There is still much to be done. The rate of smoke control progress after the Clean Air Act has been in force for twenty years is still slow and has recently slowed down because of economic considerations. As air has become cleaner, other pollutants have become more noticeable—e.g. heavy metals—lead from motor car exhausts. Odours seem to have become more apparent, and they are difficult to control; but research is being carried out by Warren Spring Laboratory. Greatest need is awareness of the problem—what has been done and what still needs to be done.

The Cost of Air Pollution

A general enquiry into the cost of air pollution in Britain made by a sub-committee of the Beaver Committee, the findings of which were included as an appendix in the final report of the Committee in 1954 estimated the total cost at that time as some £250m a year.

In November 1972, the Programmes and Analysis Unit of the Department of Trade and Industry and the United Kingdom Atomic Energy Authority published their report "An Economic and Technical Appraisal of Air Pollution in the United Kingdom". This report quotes the direct annual cost of air pollution as some £410m. a year, the major items being:

	£m per annum
Laundry etc,	½
Window cleaning	5
Corrosion and protection of metals	42
Textiles, paper, etc.	33
Agricultural produce	195
Health	130

In addition, the report estimates that there is a "social" or disamenity cost to the country of about £780m. a year, which includes £510m. for health and £100m. for amenity.

The total cost of air pollution in the United Kingdom may therefore be said to be of the order of £1190m. a year at 1972 prices. This represents about two per cent of the gross national product.

Expenditure on Air Pollution Control

The amount of money spent by scheduled works in capital working costs between 1958 and 1968 has been estimated from the returns submitted and is summarised in the table below. Working costs include depreciation and interest, operations, maintenance and repairs, overheads and miscellaneous.

(*From the 105th Annual Report of the Chief Alkali Inspector, 1968*)

Works	*Capital*	*Research and Development*	*10-year Working Costs*	*Latest year's Working Costs*
1. Electricity	75,731,000	856,000	126,691,000	15,300,000
2. Cement	6,216,000	301,000	6,442,000	1,000,000
3. Petroleum	6,822,000	536,000	11,667,000	1,788,000
4. Gas	2,839,000	—	4,474,000	350,000
5. Coke Ovens	2,909,000	242,000	6,126,000	710,000
6. Lime	976,000	4,000	707,000	118,000
7. Ceramics	2,090,000	163,000	3,011,000	382,000
8. Iron and Steel	26,430,000	1,235,000	93,351,000	10,364,000
9. Non-ferrous Metals	5,762,000	656,000	16,449,000	2,262,000
10. Chemical	20,527,000	952,000	55,516,000	6,782,000
TOTALS (£)	**150,302,000**	**4,945,000**	**324,434,000**	**39,056,000**

Estimates of Air Pollution in the United Kingdom in the Year 1973

Table 1

Estimates of Pollution by Smoke and Oxides of Sulphur from the Main Uses of Primary Forms of Energy

(*one metric tonne*=0·9842 *long ton*)

Estimates prepared by Albert Parker, CBE, DSc.

Figures for quantities of forms of energy were derived from the Digest of United Kingdom Energy Statistics issued by the Department of Energy and published by HMSO in 1975. *The percentages of sulphur in the amounts of the various grades of fuel used in making the estimates of pollution by sulphur oxides were provided by the coal, oil and electricity supply industries.*

Form of Energy and Class of Consumer	*Million Metric Tonnes*	
	Quantity of Energy	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miners' coal	14·4	0·44
Railways	0·1	small
Industrial and miscellaneous including collieries	16·0	0·05
	30·5	0·49
Sulphur oxides		
Coal		
Domestic, including miners' coal	14·4	0·24
Electricity power stations	76·9	2·04
Railways	0·1	small
Collieries	1·4	0·03
Industrial and miscellaneous	14·6	0·30
Coke ovens	21·9	0·10
Gas supply industry for gas making	0·5	0·01
Low temperature carbonization plants	2·2	0·01
Patent fuel plants	1·4	small
	133·4	2·73
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels	4·8	0·08
Industrial and miscellaneous	3·0	0·05
	7·8	0·13
Oil		
Domestic	3·8	0·02
Electricity power stations	17·0	0·95
Petroleum refineries	3·9	0·22
Industrial and miscellaneous	52·3	2·32
Gas supply industry for gas making	2·3	small
Railways	1·0	0·02
Marine craft (inland)	1·5	0·03
	81·8	3·56
Sulphur oxides overall total		6·42

Note to Table 1. The writer has found that many who use figures such as those in Table 1 assume that they are very accurate and draw unjustifiable conclusions from comparing the figures for one year with those for another year. It should be realized that though the National Coal Board, for example, may know how much coal they have sold in a particular year they do not know precisely how much has been used because of changes in unused stocks held by the users and merchants. This is indicated by the fact that the Digest of UK Energy Statistics gives the coal consumed in the UK in the calendar year 1973 as 131·3m tons (133·4m tonnes) but 120·4m tons (122·3m tonnes) for the year 1st April 1973 to 31st March 1974. For reasons of this kind it is not justifiable to draw precise conclusions from differences of less than 10 per cent in the amounts of smoke and sulphur oxides from one year to another.

Coal equivalents in m. tonnes of energy consumption in the UK in 1973 as calculated by the UK system of factors

Coal	133·4	38·0%
Oil	162·0	46·0%
Natural gas	44·2	12·6%
Nuclear electricity	10·0	2·8%
Hydro electricity	2·0	0·6%
	351·6	100·0

The conversion factors used by the EEC and the factors used by the UN both differ from the UK system and both give lower totals for coal equivalents than are obtained by the UK system.

Table 2

Estimates of Pollutants from Road Vehicles in the United Kingdom in the Year 1973 in Million Tonnes

Consumption of Motor Spirit 16·92 m. tonnes
Consumption of Derv Fuel 5·66 m. tonnes

Pollutant	*Petrol Engines*	*Diesel Engines*
Carbon monoxide	8·0	0·12
Hydrocarbons	0·39	0·024
Aldehydes	0·01	0·003
Oxides of nitrogen	0·25	0·08
Oxides of sulphur	0·016	0·03

The estimated quantity of carbon monoxide discharged into the air from the other industrial and domestic uses of all fuels in the year 1973 is about 9 m. tonnes including about 3·5 m. tonnes from domestic heating appliances. These discharges are above ground level whereas the discharges from road vehicles are at ground level.

Lead

The total amount of lead in the lead alkyl compounds added to the 16·92 m. tonnes of motor spirit used in the UK in 1973 was about 12,197 tonnes, or an average of 0·53g of lead per litre. The lead would be converted to complex compounds and about one-third would be retained in the lubricating oil and in the exhaust system. This means that the amount of lead in the compounds discharged in the exhaust gases from petrol driven vehicles in 1973 was about 8,100 tonnes.

Comparison of Air Pollution Statistics

by Albert Parker, CBE, DSc.

The figures in the following Tables A and B, prepared by Albert Parker, CBE, DSc., were derived from the statistics issued in 1955 by the Ministry of Fuel and Power, from 1956 to 1969 by the Ministry of Power, in 1970 by the Ministry of Technology and from 1971 to 1973 by the Department of Trade and Industry. The publications are available from H.M. Stationery Office. The factors used to obtain the coal equivalents given in Table A were

1 tonne of petroleum=1·7 tonne of coal.

280 therms of natural gas and colliery methane=1 tonne of coal.

Nuclear and hydro electricity were converted to the amount of coal needed to produce the same amount of electricity at the efficiency of contemporary steam power stations.

Table A.—Coal Equivalents of the Primary Forms of Energy used in the United Kingdom in 1938, 1956, and Each Year from 1960 to 1972.

Quantities in Million Metric Tonnes

Year	*Coal*	*Oil*	*Hydro Electricity*	*Nuclear Electricity*	*Natural Gas*	*Total*	*Per Capita Tonnes*
1938	178·5	12·6	0·7	—	—	191·8	4·03
1956	217·4	38·1	1·3	—	—	256·8	5·03
1960	198·6	66·6	1·7	0·9	0·1	267·9	5·09
1961	193·1	72·1	2·1	1·1	0·1	268·5	5·08
1962	194·0	79·9	2·1	1·5	0·1	277·6	5·18
1963	196·9	86·7	1·8	2·5	0·2	288·1	5·37
1964	189·6	94·8	1·9	3·2	0·3	289·8	5·35
1965	187·6	104·4	2·3	6·1	1·2	301·6	5·50
1966	176·7	113·5	2·4	7·9	1·1	301·6	5·49
1967	165·6	121·2	2·7	9·0	1·9	300·4	5·46
1968	167·1	127·9	2·2	10·3	4·5	312·0	5·64
1969	163·7	137·9	2·0	10·7	8·5	322·8	5·81
1970	156·9	147·9	2·6	9·6	16·2	333·2	5·98
1971	140·9	149·7	1·8	9·9	26·2	328·5	5·91
1972	122·8	160·1	2·0	10·7	37·3	332·9	5·96

Table B.—Quantities of Coal used in the United Kingdom in 1938, 1956 and Each Year from 1960 to 1972 in Grates or Furnaces that may cause Smoke Emission.

Million Metric Tonnes

Year	*Domestic excluding Miners'*	*Miner's Coal*	*Railways*	*Power Stations*	*Industrial* Miscellaneous and Collieries*
1938	47·3	4·7	13·6	15·3	61·1
1956	31·1	5·4	12·3	46·3	63·6
1960	29·6	5·1	9·1	53·5	48·3
1961	27·5	4·8	7·8	56·3	46·1
1962	27·9	4·8	6·2	61·4	43·9
1963	27·3	4·7	5·0	67·9	42·5
1964	23·4	4·4	3·9	68·5	40·5
1965	22·8	4·3	2·8	70·4	39·4
1966	21·2	3·9	1·7	69·0	36·6
1967	19·1	3·7	0·8	67·7	34·3
1968	18·4	3·3	0·2	75·6	29·7
1969	17·1	2·9	0·2	77·1	27·8
1970	15·4	2·7	0·1	77·2	25·6
1971	13·1	2·5	0·1	68·9	18·5
1972	10·6	2·2	0·1	66·7	15·9

* *excluding coke ovens, gas supply industry and plants for making solid smokeless fuels.*

Table C.—Estimates of Air Pollution by Smoke and Oxides of Sulphur from the Uses of Coal, Coke and Oil in the United Kingdom in 1938, 1956 and Each Year from 1960 to 1972.

Estimates made by Albert Parker, CBE, DSc.

Million Metric Tonnes

	Smoke		*Oxides of Sulphur*			
Year	*Domestic*	*Total*	*Coal*	*Coke**	*Oil*	*Total*
1938	1·74	2·75	3·89	0·24	0·06	4·19
1956	1·28	2·29	4·52	0·36	0·54	5·42
1960	1·21	1·47	4·37	0·36	1·26	5·99
1961	1·20	1·44	4·30	0·37	1·38	6·05
1962	1·18	1·42	4·32	0·36	1·51	6·19
1963	1·08	1·22	4·51	0·35	1·62	6·48
1964	0·98	1·14	4·34	0·31	1·74	6·39
1965	0·88	1·03	4·31	0·31	1·91	6·53
1966	0·84	0·98	4·03	0·29	2·05	6·37
1967	0·76	0·88	3·70	0·28	2·12	6·10
1968	0·75	0·84	3·72	0·29	2·13	6·14
1969	0·70	0·78	3·69	0·26	2·31	6·26
1970	0·64	0·72	3·40	0·17	2·50	6·07
1971	0·47	0·52	2·84	0·13	2·44	5·41
1972	0·45	0·50	2·34	0·13	2·73	5·20

* *including other solid smokeless fuels.*

Observations on Tables A, B, and C

Table A

The figures in Table A show that the coal equivalent of the primary sources of energy used in the United Kingdom increased by about 74 per cent from 191·8 m. tonnes in 1938 to 332·9 m. tonnes in 1972. Over that period the population rose by nearly 18 per cent from 47·5 m. to 55·9 m., so that the coal equivalent per capita increased by 48 per cent from 4·03 to 5·96 tonnes. The proportion of the coal equivalent provided by coal decreased from 93 per cent in 1938 to 37 per cent in 1972, while the percentage provided by oil rose from 6·6 in 1938 to 48 in 1972. Throughout the period 1938 to 1972, hydro electricity provided less than 1 per cent of the total coal equivalent; nuclear electricity was less than 1 per cent from 1960 to 1963 and then increased to about 3 per cent over the years 1967 to 1972. Natural gas provided less than 1 per cent from 1960 to 1967 and then rose each year to reach 11 per cent in 1972. As a result, of the coal equivalent of the total consumption of primary forms of energy in 1972, the percentages were oil 48, coal 37, natural gas 11, nuclear electricity 3 and hydro electricity less than 1.

Table B

The burning of bituminous coal in domestic open grates leads to the emission of much more smoke per tonne of coal than any of the other uses of coal given in Table B. The domestic use of coal, excluding miners' coal, fell from 47·3 m. tonnes in 1938 to 10·6 m. tonnes in 1972. The main reasons for this great decrease are first that during the war (1939-45), coal and coke for domestic use were rationed. In consequence, householders began to use more electricity and gas for heating and decided that these were more convenient and cleaner than heating by coal. Secondly, in 1956 there was the Clean Air Act which has enabled local authorities to establish smoke control areas in which the burning of bituminous coal in open domestic grates is prohibited. It was a few years before an appreciable number of smoke control areas had been established; progress in this direction has continued but not so rapidly as desirable. Thirdly, since 1945 there has been an increase in the number of housewives taking employment; this has led to an increasing demand for convenient gas and electric methods of heating.

It is difficult to estimate the relative effects of the three factors. The reduction in the amount of concessionary coal to miners from 5·4 m. tonnes in 1956 to 2·2 m. tonnes in 1972 was due to a substantial reduction in the number engaged in the deep mining of coal.

From 1956 to 1970, steam-driven railway locomotives, which emitted smoke, were steadily replaced by diesel engines and electric traction so that the consumption of coal by the railways fell from 12·3 m. tonnes in 1956 to 0·1 m. tonnes in 1970. The coal consumption by power stations increased from 15·3 m. tonnes in 1938 to 46·3 m. tonnes in 1956 and 70·4 m. tonnes in 1965, with later fluctuations, and a maximum of 77·2 m. tonnes in 1970. Power stations also consumed considerable quantities of oil. Industrial undertakings and collieries reduced their consumption of coal from 63·6 m. tonnes in 1956 to 15·9 m. tonnes in 1972 by replacing coal by oil, by electricity from the public supply, and to some extent, during 1970 to 1972, by natural gas.

Table C

The observations on the figures in Tables A and B give the reasons for the great reduction in the emission of smoke from domestic open fires. The percentage reduction in smoke emission from the uses of coal by industry for raising steam and heating furnaces was greater than the percentage reduction in the amount of coal used. This was partly due to the Clean Air Act which indirectly stimulated efforts to improve the efficiency of use of coal by industry. The emission of smoke from the use of coal by industry and the railways has been reduced over the years 1956 to 1972 by 95 per cent from 1·01 to 0·05 m. tonnes. Over the same period, the emission of smoke from domestic fires has been reduced by 65 per cent from 1·28 to 0·45 m. tonnes. In 1956, of the 2·29 m. tonnes of smoke, 56 per cent was from domestic fires and 44 per cent from the uses of coal by industry and the railways. In 1972, of the 0·50 m. tonnes of smoke emitted, 90 per cent was from domestic fires. It is clear that further effort should be made to reduce smoke emission from domestic chimneys.

The estimated emission of oxides of sulphur from the uses of coal, coke and oil rose from 5·4 m. tonnes in 1956 to 6·5 m. tonnes in 1965, and then declined gradually to 5·2 m. tonnes in 1972. Over the years 1956 to 1969, the amount of oxides of sulphur each year was approximately in proportion to the coal equivalent of the coal and oil consumed. In 1971 and 1972, there was some reduction in the average percentage of sulphur in the coal and oil used.

A. Parker

GARDEN BONFIRES

Prevention of Smoke Nuisance

1. Compost garden rubbish as far as possible.
2. Large woody cuttings etc. that are unsuitable for compost should be thoroughly dried before being burnt. A quick, hot fire will produce the minimum of smoke.
3. Do not light a bonfire if the wind is going to cause the smoke to be a nuisance to *anyone*.
4. Do not light a fire within an hour of sunset, or leave it alight later than one hour after sunset. Inversion effects increase the smoke problem.
5. No fire should be left unattended.
6. Some local authorities are prepared to collect garden rubbish along with household rubbish in the ordinary way; some others are prepared to take away garden rubbish for a small charge. The National Society for Clean Air are continuing to encourage more local authorities to help householders in this way. But if the collection of garden rubbish cannot be arranged, *never* add household rubbish to a garden bonfire: many materials are quite unsuitable for open, low-temperature combustion, and local authorities are equipped to deal with miscellaneous refuse.

Legal Position

Under Section 16 of the Clean Air Act 1956, referring to smoke nuisance, a smoky bonfire could be in contravention of the Act. If the local authority are satisfied that a nuisance has occurred, temporarily ceased, but is likely to recur, it may, without serving an Abatement Notice, cause a complaint to be made to the Magistrates' Court for the making of a Nuisance Order. Following this, the provisions of Part III of the Public Health Act 1936 for Enforcement of the Order will apply. It is unlikely that such action would be taken unless the offending bonfire(s) occurred very frequently, and witnesses were produced to that effect.

The use of SI Units in Environmental Technology

by

H. M. Glass

Introduction

Sir Isaac Newton derived some laws of motion for inanimate bodies. With slight modification they also apply to human behaviour. Everybody continues in a state of rest unless compelled to change that state by external and internal forces. And if they do change, they always give vent to an equal and opposite reaction.

The move to put the metric system into practice in this country has provided further evidence, if any were needed, of the truth of these "laws". Yet the metric system, in its most recent version as the International System of Units (SI), is in many respects an improvement on earlier metric systems and the imperial system. A main defect of the imperial system is the lack of rational series of multiples connecting different magnitudes of a given physical quantity. Thus the numbers 12, 3, 22, 10 and 8 connect the inch, foot, yard, chain, furlong and mile. Similarly the numbers 437·5, 16, 14, 28, 4 and 20 connect the grain, ounce, pound, stone, quarter, hundredweight and ton. On the other hand, in SI the single factor 10 connects the millimetre, centimetre, decimetre, metre, decametre, hectometre and kilometre; and the single factor 1000 connects the microgram, milligram, gram, kilogram and megagram. The imperial system also suffers from complex relationships between associated physical quantities. To take an example, one horsepower is equal to 550 foot pound-force per second, and to 0·707 British thermal units per second. It is much simpler in SI where the corresponding relationship is that one newton metre per second is equal to 1 joule per second and to 1 watt.

This happens because SI is a coherent system. Thus the SI unit of energy results when the SI unit of force is multiplied by the SI unit of length; and the SI unit of power results when the SI unit of energy is divided by the SI unit of time. No numerical factors other than unity are involved. In comparison, coherence in the imperial system is almost non-existent.

Basis of SI

The system includes three classes of units:

(1) base units,
(2) supplementary units,
(3) derived units.

The base units are:

Quantity	Name of base unit	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
luminous intensity	candela	cd
amount of substance	mole	mol

Many of these units are familiar, having for decades been used in the centimetre-gram-second (CGS) system, now superseded by SI. As regards temperature, the degree Celsius (°C) is the same temperature *interval* as the kelvin and is in general use.

The supplementary units are those of plane and solid angle, respectively the radian and steradian. However, in normal measurement of plane angles the degree of angle (360° in a circle) will continue to be used.

The derived units are expressed in terms of the base units and/or the supplementary units. For some SI derived units some special names and symbols exist: for example the unit of force, 1 kg m/s^2, is called the newton (symbol N) and is a corner-stone in the construction of the International System. A number of common derived units are listed below, and their unit (coherent) relationships with the base units given.

Quantity	Name of derived unit	Symbol	Relationship to other units
force	newton	N	$1\text{N} = 1\text{ kg m/s}^2$
pressure	pascal	Pa	$1\text{Pa} = 1\text{ N/m}^2$
work, energy, quantity of heat	joule	J	$1\text{J} = 1\text{ N m}$
power	watt	W	$1\text{W} = 1\text{ J/s}$
frequency	hertz	Hz	$1\text{Hz} = 1\text{ s}^{-1}$
electromagnetic force	volt	V	$1\text{V} = 1\text{ W/A}$
electric resistance	ohm	Ω	$1\Omega = 1\text{ V/A}$

This table illustrates an important result in applying SI units in the field of power. Because of coherence, a simple bridge between the different forms of power is provided:

1 W = 1 A × 1 V (electric power)
= 1 J/s (thermal power)
= 1 N m/s (mechanical power)

To complete the picture of basic features of SI, multiples and sub-multiples of SI units are formed by adding prefixes to the units, all prefixes being integer powers of ten. A selection of these is given:

Factor by which the unit is multiplied	Prefix	
	Name	Symbol
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^2	hecto	h
10	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ

Just as the prefix name is attached to the name of the unit, e.g. centimetre, *not* centi metre, the symbol of a prefix is considered to be combined with the symbol of the unit, to which it is directly attached. For example,

cm, not c m

If the unit is raised to some power, the exponent applies equally and algebraically to the prefix

e.g. 1 $cm^3 = (10^{-2}m)^3 = 10^{-6}m^3$.

There are a number of practices in the written and printed use of units which are often neglected but which must be used to avoid confusion:

(1) Many SI units are named after distinguished international scientists. The initial letters of these names are written in lower case, not in a capital letter: e.g. newton, *not* Newton. However, the symbol is always a capital letter, but if there are two or more letters in the symbol, only the first is a capital letter: e.g. N for newton, Pa for pascal. The name Celsius might be thought to be an exception, but this is not really so as the degree Celsius is not a true SI unit.

(2) A space must be allowed between the number and the unit. Just as one writes "twenty centimetres" and not "twentycentimetres", one must also write "20 cm". This also applies to Celsius temperature; one writes "20 °C", not "20°C".

(3) Unit symbols must be used in the singular even when the magnitude of the quantity is more than one unit, i.e. "20 cm" not "20 cms". Further, the symbol does not carry a full stop after it, except if it is placed at the end of a sentence.

(4) Derived units that are compound expressions of the quotient type, e.g. thermal conductivity for which the SI unit could be defined as "watt per metre per kelvin", must be expressed in symbolic form with only one solidus as the division sign. Thus the unit for thermal conductivity is written as

"W/(m K)" and *not* as "W/m/K".

The approved mode of expression in words is

"watt per metre kelvin".

Units in Environmental Technology

In environmental studies, a number of physical quantities recur. It is useful to consider the SI units for these and it is also worth pointing out that in calculations associated with plant design in relation to effluents, etc, it is an advantage to work in SI units, because the principle of coherence, with its factor of unity, makes the calculations simpler since no arithmetic conversion is involved.

As to key units, the following observations apply. For more precise conversion factors than are given in these observations, reference should be made to BS 350, Part 1: 1974. The physical quantities dealt with are Concentration, Height, Particle size, Bulk mass, Time, Fuel rate, Pressure, and Energy.

(1) **Concentration.** The concentration of dust and grit in chimney effluents is still frequently expressed in grains per cubic foot, in part due to the time being taken to metricate the units of existing legislation. But the grain should now be regarded as an obsolete unit of mass. Sometimes the alternative expression "parts per million" (symbolised as "ppm") is used, but it lacks precision. Parts by mass or by volume per million what?

In the last year or two an attempt has been made by environmental scientists to express concentration in an SI unit. Unfortunately the unit invented is misleading. The strict SI unit in terms of base units is kilogram per cubic metre (kg/m^3). However, this has too great a magnitude for application to common dust concentrations, so appropriate sub-multiples have to be used. These are g/m^3, mg/m^3 or $\mu g/m^3$. The unit invented by environmentalists is mg/Nm^3 which in SI means milligram per newton cubic metre. The concept of mass divided by energy times area is unknown and the unit is therefore a howler. The mistake arises from the use of the letter N (which means the newton in SI) to indicate volume (m^3) at normal temperature and pressure. The error can be eliminated by making m^3_n stand for the "normal" cubic metre and so record concentration in mg/m^3_n.

For conversions, 1 $gr/ft^3_n = 2{\cdot}288$ g/m^3_n

(2) **Bulk Mass.** For mass for bulk amounts a suitable SI unit is the megagram (Mg) which is also known as the metric ton ("tonne" in French, and with symbol t).

For conversions, 1 UK ton = 1·016 tonne.

The word "tonne" may be used in texts but in speech it is better to say "metric ton" to avoid misunderstanding.

(3) **Time.** Even the ultra-orthodox in SI recognise that the 24 hour clock, with 60 minutes and 60 seconds, will be used for some time yet. So hour (symbol 'h', *not* 'hr'), minute (symbol 'min') and second (symbol 's', *not* 'sec') are all officially accepted.

(4) **Fuel rate.** Solid fuel rates may be expressed in t/h (tonne per hour) or kg/h; and liquid and gaseous fuels in m^3/h or litre per hour (l/h). Of course, other units of time may be used, e.g. l/min, kg/s.

The litre is a recognised SI name for the cubic decimetre (dm^3) and 1000 l = 1 m^3.

For conversion, 1 UK gallon per minute=4·546 l/min.

(5) **Pressure.** More words have been spoken about this (with many views not expressed in words) than for any other unit.

The strict SI unit is newton per square metre (N/m^2), also called the pascal (Pa). This is used in a number of industries but in hydraulic engineering and fuel gas technology the bar is the favoured unit. The bar is not a true SI unit but it has considerable appeal because its magnitude is not far removed from that of usual atmospheric pressure at sea level. In value, 1 bar = 10^5 N/m^2 so it is a decimal multiple of the SI unit but its power exponent, 5, is not one of those with an SI prefix. It is used widely in Europe and is recognised for use by the EEC Directive on Units. However, in the U.S.A., in South Africa and in Australia the pascal is in use or is to be used, to the exclusion of the bar. The pascal itself has a small magnitude and in practice it is the kilopascal and megapascal that are used. The bar is one-tenth of a megapascal.

For conversions, 1 $lbf/in^2 = 6{\cdot}895$ kPa = 0·06895 bar.

(6) **Energy.** In one form or another, energy has been sold or measured in at least seven different units: the

kilowatt hour (kW h), the foot poundal (ft pdl), the foot pound-force (ft lbf), the horsepower (hp h), the calorie (cal) (three varieties of this), the British thermal unit (Btu) and the therm. To these one may add two technical units used in metric countries, the kilogram-force metre and the litre atmosphere. There is now an opportunity to clean up this clutter of unrelated energy units by moving quickly to the SI unit, the joule (J). This equates to the amount of work done by a force of one newton operating over a distance of one metre, i.e. $1\ \text{J} = 1\ \text{N m}$. It is applied to all forms of energy and, when divided by the unit of time, the second, it transforms into the coherent unit for power, the watt.

The relationships between the joule and some other energy units are:

$$1\ \text{J} = 2{\cdot}778 \times 10^{-7}\ \text{kW h} = 0{\cdot}7376\ \text{ft lbf}$$
$$= 0{\cdot}2389\ \text{cal}_{15} = 9{\cdot}478 \times 10^{-4}\ \text{Btu.}$$

The joule is used by the British Gas Industry, mainly as the 10^6 multiple, the megajoule. It offers a convenient relationship to the unit used hitherto, the therm.

$$1\ \text{therm} = 100\,000\ \text{Btu} = 105{\cdot}5\ \text{MJ}$$

Most problems in pollution are caused by the degradation of matter from higher to lower energy levels. Study of environmental conditions, and communication between those concerned in this study, will be made considerably easier if a common technical language is adopted. The part played in this field by energy changes and their quantification is so large that the adoption of a single unit, the joule, in which to measure those changes will facilitate the comparison of effects produced by varying sets of conditions.

Conclusion

The change to metric measurement throughout the world is inevitable. Most countries already use the metric system and there is no turning back to older systems. This is reflected in the UK by the adoption of the International System of Units (SI) in teaching in schools and colleges. A generation is now entering industry and commerce which fully understands SI and favours its use because of evident technical advantages. The UK is also committed to the adoption of SI both by governmental statements and by its membership of the European Community, in which there is a Directive on Units based on the International System. It is to be hoped that the UK government will hasten the introduction of legislation to metricate regulations now written in terms of imperial units. Many industrial and commercial sectors are asking them to do this.

Nothing is to be gained by the maintenance of units which are falling into disuse. It is time to remove the paradox of environmentalists, who have the professed aim of creating greater cleanliness and order in their surroundings, permitting disorder and lack of coherence in their technical language of measurement. The adoption of SI units by everyone working in the environmental field is overdue. The simplification and understanding of data that follows from this will be of considerable benefit to environmental technology.

42nd Clean Air Conference

Edinburgh

11-15th October 1976

Monday, 11th October
Opening Session

Tuesday, 12th October
Session 2—Noise
The Provisions of the Control of Pollution Act 1974 and their Implementation.

Session 3—Smoke Control
The Present Situation (A Review) and the Way Ahead.

Wednesday, 13th October
Session 4—The Control of Air Pollution
The Findings of the Royal Commission on Environmental Pollution.

Thursday, 14th October
Session 5—Pollution in Rural Areas
Pollution of the Air, Water and Land.

Open Session— Solar Energy

Friday, 15th October
Session 7—The Disposal of Toxic Wastes

Enquiries to: NSCA, 136 North Street, Brighton BN1 1RG. Tel: (0273) 26313.

British Standards Relating to Air Pollution

B.S.

349 1973 Identification of contents of industrial gas containers. Specifies the marking and colour of industrial gas containers to identify their contents.

349C 1973 Chart for identification of contents of gas containers.

350 Conversion factors and tables.
Part 1: 1974 Basis of tables, conversion factors, subject of measurement—Metrology, Mechanics, Heat. Information on units, tables of units, conversion factors.
Part 2: 1962 Detailed conversion tables. Amendments AMD 276, July 1969; AMD 1254, Sept. 1973

749 1969 Underfeed stokers.

758 Small domestic hot-water supply boilers using solid fuel.
(Parts 1 and 2 withdrawn, superceded by BS 4433: Part 1)

779 1961 Cast iron boilers for central heating and hot water supply.

799 Oil burning equipment.
Part 1: 1962 Atomising burners and associated equipment.
Part 2: 1964 Vapourising burners and associated equipment.
Part 3: 1970 Automatic and semi-automatic atomising burners up to 36 litres per hour and associated equipment (M) Amendment AMD 1438, May 1974
Part 4: 1972 Atomising burners over 36 litres per hour and associated equipment for single and multi-burner installations (M).

845 1972 Acceptance tests for industrial type boilers and steam generators. Methodology and data for simple efficiency test at minimum cost, on hot water and steam-raising plants using solid, liquid or gaseous fuel.

855 1961 Welded steel boilers for central heating and hot water supply. Amendment PD 4627, August 1962

893 1940 Methods of testing dust extraction plant and the emission of solids from chimneys of electric power stations. Amendment PD 26, September 1942

1016 Methods for the analysis and testing of coal and coke.
Part 2: 1973 Total moisture of coke—methods of determining.

1017 The Sampling of Coal and Coke.
Part 1: 1960 COAL Amendments PD 3796, May 1960; PD 4649, September 1962
Part 2: 1960 COKE Amendments PD 4366, October 1961; PD 4650, September 1962

1250 Domestic appliances burning town gas.
Part 1: 1966 General requirements.
Part 2: 1963 Cooking appliances. Amendment PD 5852, June 1966
Part 3: 1963 Water heating appliances. Amendment PD 5391, November 1964
Part 4: 1965 Space heating appliances.
Part 5: 1963 Refrigerators. Amendments PD 5449, January 1965; PD 5587, July 1965
Part 6: 1965 Laundering appliances. Amendment PD 5805, March 1966

1251 1970 Open fireplace components. Amendments AMD 903, March 1972; AMD 1651, January 1975
4 sections dealing with dimensional, constructional and other requirements for:
(1) Firebacks for 350mm, 400mm and 450mm open fires.
(2) Fireplace surrounds and hearths.
(3) Adjustable chimney-throat restrictors.
(4) Lintels for open fire assemblies.

1252 1957 Domestic solid fuel cookers with integral boilers. Amendments PD 3383, May 1959; PD 4212, July 1961; PD 4822, February 1963
General performance requirements.

1334 1969 The use of thermal insulating materials for central heating and hot and cold water supply installations (M)

1344 Methods of testing vitreous enamel finishes.
Part 3: 1967 Resistance to products of combustion containing sulphur compounds (M)

1747 Methods for the measurement of air pollution.
Part 1: 1969 Deposit gauges (M)
Part 2: 1969 Determination of concentration of suspended matter (M)
Part 3: 1969 Determination of sulphur dioxide (M)
Part 4: 1969 The lead dioxide method (M)
Part 5: 1972 Directional dust gauges (M)

1756 1971 Methods for the sampling and analysis of flue gas.
Part 1: 1971 Methods of sampling (M)
Part 2: 1971 Analysis by the Orsat apparatus (M)
Part 3: 1971 Analysis by the Haldane apparatus (M)
Part 4: 1965 Miscellaneous analysis (M) Amendment PD 5858, June 1966.
Part 5: 1971 Semi-routine analyses (M)

1816 1957. Heavy duty cooking ranges (solid fuel).

1831 1969 Recommended common names for pesticides. Also supplements 1, 1970, and 2, 1970

1846 Glossary of terms relating to solid fuel burning equipment.
Part 1: 1968 Domestic appliances.
Part 2: 1968 Industrial water heating and steam raising installations (M)

1945 1971 Fireguards for heating appliances (gas, electric and oil-burning). Amendment AMD 940, April 1972

2069 1954 Gas sampling tubes.

2486 Treatment of water for land boilers—including glossary of terms used in water treatment.

B.S.

2520 1967 Barometer conventions and tables.

2740 1969 Simple smoke alarms and alarm metering devices. Amendment AMD 985, June 1972 (M)

2741 1969 Recommendations for the construction of simple smoke viewers (M)

2742 1969 Notes on the use of the Ringelmann and miniature smoke charts (M). Addendum No. 1: 1972 The calibration of instruments in Ringelmann numbers.

2742C 1957 Ringelmann Chart.

2742M 1960 Miniature Smoke Chart.

2733 1965 Domestic single-room space heating appliances for use with liquefied petroleum gases. Amendment AMD 986, June 1972 (M)

2790 Shell boilers of welded construction (other than water-tube boilers).
Part 1: 1969 Class 1 welded construction. Amendment AMD 1106, January 1973
Part 2: 1973 Class II and Class III welded construction (M)

2811 1969 Smoke density indicators and recorders. Amendment AMD 986, June 1972 (M)

2831 1971 Methods of test for air filters used in air conditioning and general ventilation.

2845 1957 Coke burning inset open fires without boiler and without convection (withdrawn, superceded by BS 4834).

2952 1970 Rating and testing room air conditioners (M)

2878 1968 Methods for determination of lead in gasoline (gravimetric method) (M)

3048 1958 Code for the continuous sampling and automatic analysis of flue gases. Indicators and recorders. (Complementary to BS 1756, which covers manually operated instruments).

3107 1973 Small incinerators (M) Amendment AMD 1630, January 1975.

3128 1959 Constructional and performance requirements for inset open fires with boiler and without convection (withdrawn, superceded by BS 4834).

3142 Manufactured solid smokeless fuels for household use (M)
Part 1: 1965 Cokes for domestic open fires.
Part 2: 1965 Cokes for domestic closed appliances.
Part 3: 1970 Specially reactive fuel for all types of domestic open fire.

3156 Methods for the analysis of flue gases.
Part 1: 1968 General analysis (M)
Part 2: 1968 Special determinations (M) Amendments AMD 120, October 1968; AMD 512, May 1970
Part 3: 1968 Combustion characteristics (M)
Part 4: 1969 Gas chromatographic analysis (M)
Part 5: 1969 Techniques for high pressure gases (M) Amendment AMD 565, August 1970

3198 1960 Combination of hot water storage units (copper) for domestic purposes. Amendments PD 6395, April 1968; AMD 224, March 1969

B.S.

3250 Methods for the thermal testing of domestic solid fuel burning appliances with convection.
Part 1: 1973 Flue loss method (M)
Part 2: 1961 Hood method. Amendment PD 4205, June 1961

3300 1974 Kerosene (paraffin) unflued space heaters, cooking and boiling appliances for domestic use (M)

3316 1960 Large incinerators for the destruction of hospital waste.

3328 1961 Domestic gas pokers and portable underbar ignition burners.

3376 1961 Open fires with convection, with or without boiler.

3377 1969 Back boilers for use with domestic solid fuel appliances (M)

3378 1972 Room heaters burning solid fuel (M) Amendment AMD 1199, June 1973

3405 1971 Simplified methods for measurement of grit and dust emission (M)

3446 1962 Glossary of terms relating to the manufacture and use of refractory materials.

3456 Safety of household electrical appliances.
Part A: 1966 General requirements. Amendments PD 6250, September 1967; AMD 181, January 1969; AMD 521, May 1970; AMD 914, March 1972;
Section A2: 1962 Electric room heaters. Amendments PD 4929, May 1963; PD 5054, October 1963; PD 5203, April 1964; AMD 51, August 1968; AMD 281, July 1969; AMD 538, June 1970; Withdrawn, superceded by Section 2.10.
Section A8: 1963 Electric immersion heaters. Amendments AMD 154, November 1968; AMD 392, December 1969. Withdrawn, superceded by Section 2.21.
Section A11: 1966 Thermal storage room heaters. Amendments AMD 61, August 1968; AMD 792, August 1972; AMD 1655, January 1975. Will be superceded by Section 2.26.
Section A12: 1962 Electric cookers and boiling plates. Amendments PD 5491 March 1965; PD 5649; September 1965; AMD 26, July 1968; AMD 563, August 1970; AMD 803, September 1971; AMD 973, June 1972. Superceded by Section 21.
Part C: 1967 Electrical refrigerators and food freezers (M) Amemdnent AMD 412, January 1970; AMD 662, December 1970; AMD 1138, May 1973. Will eventually be withdrawn and superceded by Section 2.24.
Part 1: 1974 General requirements (M)
Part 2: Particular requirements.
Section 2.1: 1972 Cooking ranges; cooking tables and similar appliances (M)
Section 2.7: 1970 Stationary non-instantaneous water heaters (M) Amendment AMD 882, March 1972
Section 2.10: 1972. Room heating and similar appliances (M)
Section 2.21: 1972 Electric immersion heaters (M)
Section 2.22: 1972 Electricaire heaters (M) Amendment AMD 1664, February 1975
Section 2.23: 1971 Cooker ventilating hoods (M)
Section 2.26: 1973 Thermal storage electrical room heaters (M) Amendment AMD 1631, January 1975
Section 2.29: 1971 Ventilating fans (M) Amendment 1306, November 1973
Section 2.30: 1971 Food waste disposal units (M)
Section 2.39: 1973 Room humidifiers (M)

B.S.

3561 1962 Non-domestic space heaters burning town gas. Amendments PD 5656, October 1965; AMD 448, February 1970

3755 Methods of test for the assessment of odour from packing materials used for foodstuffs. Amendment AMD 684, March 1971

3813 Incinerators for waste from trade and residential premises.
Part 1: 1964 Capacities between 50 lb/h and 1000 lb/h.

3841 1972 Method for the assessment of smoke from manufactured solid fuels for domestic open fires (M)

3879 1969 Portable liquefied petroleum gas appliances operating at vapour pressure from small LPG containers (M)

3899 1965 Refrigerated room air-conditioners. Amendment AMD 370, November 1969

3929 1965 Domestic solid fuel ignition pokers and portable undergrate ignition burners for use with commercial butane.

3955 Electrical goods for domestic appliances.
Part 1: 1965. General requirements. Amendments AMD 12, June 1968; AMD 459, March 1970
Part 2: Specific requirements.
Section 2A: 1967 Manually operated appliance switches. Amendments AMD 13, June 1968; AMD 436, February 1970
Section 2B: 1966 Thermostats for electrically heated hot water supply. Amendments AMD 14, June 1968; AMD 437, February 1970

3958 Thermal insulating materials.
Part 1: 1970 85% magnesia preformed insulation (M). Amendment AMD 929, April 1972
Part 2: 1970 Calcium silicate preformed insulation (M). Amendment AMD 930, April 1972
Part 3: 1967 Metal mesh faced mineral wool mats and mattresses (M)
Part 4: 1968 Bonded preformed mineral wool pipe sections (M). Amendment AMD 145, November 1968
Part 5: 1969 Bonded mineral wool slabs (for use at temperatures above 50°C) (M)
Part 6: 1972 Finishing materials; hard setting composition, self-setting cement and gypsum plaster (M)

4076 1966 Steel chimneys. Amendments AMD 1002, August 1972; AMD 1614, November 1974

4096 1967 Non-domestic space heaters burning liquefied petroleum gases. Amendment AMD 118, October 1968

4201 1969 Thermostats for gas burning appliances. Amendment AMD 447, February 1970 (M)

4207 1967 Monolithic linings for steel chimneys and flues. (M)

4257 Oil burning air heaters.
Part 1: 1972 Non-domestic, transportable, fan-assisted heaters (M)
Part 2: 1972 Fixed, flued, fan-assisted heaters (M)
Part 3: 1972 Fixed, flued, convector heaters (M)

4350 1971 Method for determination of sulphur in petroleum products (lamp method) (M)

B.S.

4379 1969 Determination of calorific value of liquid fuel.

4433 Solid smokeless fuel boilers with rated outputs up to 45kW.
Part 1: 1973 Boilers with undergrate ash removal (M). Supercedes BS 758: Parts 1 and 2.
Part 2: 1969 Gravity feed boilers designed to burn small anthracite (M)

4543 1970 Factory-made insulated metal chimneys. Amendments AMD 749, June 1971; AMD 919, March 1972

4555 1970 High efficiency dust respirators.

4558 1970 Positive pressure, powered dust respirators.

4642 1970 Glossary of industrial furnace terms.

4834 1972 Inset open fires without convection (M)

4876 1972 Performance requirements and test procedures for domestic flued oil burning appliances (M)

5258 Safety of domestic gas appliances.
Part 2: 1975 Cooking appliances (M)

PD 6434 1969 Recommendations for the design and testing of reducing solid fuel burning appliances.

CODES OF PRACTICE

CP3 Chapter 1(c): 1950 Ventilation.
Chapter X: 1950 Precautions against vermin and dirt.

CP94 1971 Demolition (M) Amendment AMD 1090, January 1973

CP131 101 1974 Chimneys and flues for domestic appliances burning solid fuel (M)

CP331 Installation of pipes and meters for town gas.
Part 1: 1973 Service pipes (M)
Part 2: 1974 Low pressure metering (M)
Part 3: 1974 Low pressure installation pipes (M)

CP332 Selection and installation of town gas space heating.
Part 1: 1961 Independent domestic appliances. Amendment PD 5611 August 1965
Part 2: 1964 Central heating boiler for domestic premises. Amendment PD 5612, August 1965; AMD 529, June 1970
Part 3: 1970 Boilers of more than 150,000 Btu/h (44kW) and up to 2,000,000 Btu/h (586kW) output.
Part 4: 1966 Ducted warm air systems. Amendment AMD 355, November 1969

CP333 Selection and installation of town gas hot water supplies.
Part 1: 1964 Domestic premises. Amendment PD 5608, August 1965
Part 2: 1948 Schools. Amendment PD 5609, August 1965

CP334 Selection and installation of town gas cooking and refrigerating appliances.
Part 1: 1962 Domestic cooking appliances. Amendment PD 5613, August 1965
Part 2: 1966 Cooking installations for educational establishments.
Part 3: 1971 Refrigerators (M)

CP335 Selection and installation of miscellaneous town gas appliances.
Part 1: 1973 Domestic laundering and miscellaneous appliances (M)

CP337 1963 Flues for gas appliances up to 150,000 Btu/h rating. Amendment PD 5607, August 1965

CP338 1957 Domestic propane-gas-burning installations in permanent dwellings. Amendments PD 2965, January 1958; PD 4809, February 1963

CP339 Domestic butane-gas-burning installations.
Part 1: 1965 Installations in permanent dwellings. Amendments PD 2781, May 1957; PD 2962, January 1958; PD 4810, February 1963
Part 2: 1965 Installations in caravans and small non permanent dwellings. Amendments PD 2718, February 1957; PD 2782, May 1957; PD 2963, January 1958; PD 3863, July 1960; PD 4811, February 1963; PD 5292, July 1964
Part 3: 1956 Installations in boats, yachts and other vessels. Amendments PD 2783, May 1957; PD 2964, January 1958; PD 4812, February 1963

CP340 1966 Installation of solid fuel stoves in caravans. Amendment AMD 1486, July 1974

CP341 1956 Central heating by low pressure hot water. Amendment AMD 974, June 1972

CP342 Centralized hot water supply.
Part 1: 1970 Individual dwellings.
Part 2: 1974 Buildings other than individual dwellings (M)

CP352 1958 Mechanical ventilation and air-conditioning in buildings.

CP403 1974 Installation of domestic heating and cooking appliances burning solid fuel (M)

CP 3000 1965 Installation and maintenance of underfeed stokers.

CP 3002 Oil firing.
Part 1: 1961 Installations burning class D fuel oil and C.T.F. 50. Amendment PD 4758, December 1962
Part 2: 1964 Installations burning class C and class D fuel oils for vapourising burners.
Part 3: 1965 Installations buring pre-heated fuels. Class E, F and G fuel oils and C.T.F. 100 to 250.

CP 3006 Part 1: 1969 Low pressure forced circulation hot water (small bore) systems. Amendment AMD 465, March 1970

CP 3008 1970 The use of transportable industrial spaceheaters (M)

A11 141a 1971 The performance of diesel engines for road vehicles (M)

Note: (M) indicates standards in which the requirements are specified in metric units.

SECTION 3

NOISE

Page
Noise and the Law 82
Noise and Noise Measurement 83
British Standards Relating to Noise 85

NOISE AND THE LAW

The Control of Pollution Act, 1974

The Control of Pollution Act, 1974 significantly extends the powers of local authorities to deal with noise problems. It makes it a statutory duty of every local authority to cause its area to be inspected from time to time to detect noise nuisances and to assess what action they should take to exercise powers conferred upon them by the Act in relation to noise abatement zones.

Local authorities, when satisfied that a noise nuisance exists within their area, or if one is likely to occur or recur, must by notice require the abatement of the nuisance or prohibit or restrict its recurrence; further they may require works to be carried out or the taking of other steps which may be necessary to fulfill the requirements of the notice. Power is also conferred on local authorities to take the same action when noise affects their area but emanates from the area of another local authority. In either case the local authority can institute proceedings in the High Court if they are of the opinion that procedings in a lower court would not afford an adequate remedy, notwithstanding that the local authority themselves have suffered no damage.

Section 59 of the act gives the right to any individual who, as the occupier of land is aggrieved of a noise nuisance, to make complaint to a magistrates' court. The court, if satisfied that the complaint is justified, is given power to make an order requiring a defendant to abate the nuisance, and if necessary to this end, to execute works. Such an order can also prohibit the recurrence of a nuisance and require the defendant to execute works which may be necessary to prevent recurrence. It should be noted here that this power of an individual to act on his own behalf in relation to noise nuisance is in a sense an extension of the power conferred on any three individuals by the Noise Abatement Act, 1960, who as occupiers of land, were aggrieved of a noise nuisance. This means that noise nuisance is no longer in a special category in this respect and that an aggrieved individual has the same rights to complain directly to a magistrates' court, as has any individual to similiarly complain, in respect of any other nuisance under the provisions of the Public Health Act, 1936.

The act also addresses itself in the problem of noise from construction sites, road and bridge works, demolition and dredging works and works of engineering construction. Where it appears to a local authority that such works are going to be carried out, they may by notice impose requirements as to the manner in which the work is effected. The type of plant to be used or plant which may not be used can be specified. Hours of work may be imposed, and maximum noise level emissions from the site can be laid down. In exercising these powers local authorities must amongst other things have regard to relevant codes of practice and give due consideration to the interests of the firm carrying out the works.

The British Standards Institution have issued a code of practice relating to noise control on construction and demolition sites (BS.5228: 1975) which should be read in conjunction with Part 3 of the Act.

Machinery for a system of 'prior consent' to carry out any work to which the act relates is laid down in Section 61. The provisions of the Noise Abatement Act, 1960 relating to noise in streets caused by loudspeakers and sound amplifying devices such as chimes to advertise ice cream etc, are retained by the act. This means that no loudspeaker can be operated in any street between the hours of nine in the evening and eight the following morning for any purpose whatsoever and cannot be used at any time whatsoever for advertising any trade or business. (Except that perishable foods can be so advertised between the hours of noon and seven in the evening, so long as words are not used, and it is done in such a way as to not give reasonable cause for annoyance).

A very significant measure introduced is the power of local authorities to designate noise abatement zones in which noise from premises must not exceed a registered level (which is, in effect, the level measured by the local authority as emanating from the premises at a time after the area has been designated). The Act contains provisions for appeal to the Secretary of State in the case of disagreement between the local authority and the occupier of a premises as to what level should be registered. Powers are also granted to local authorities to bring about reductions in noise levels in cases where they appear to be excessive in the case of existing premises, and to control noise levels from new buildings erected in the area after its designation.

Regulations can be made by the Secretary of State for controlling noise from plant or machinery by requiring the use in connection with such machinery of devices to reduce noise, and also for limiting noise from machinery used on construction and other open air sites.

The Control of Pollution Act, 1974 repeals the Noise Abatement Act, 1960 except that notices served by a local authority to abate nuisance under Section 1 of the 1960 Act before the operation of the new act are not affected.

The Land Compensation Act 1973

As the Control of Pollution Act, 1974 has brought added powers to local authorities to control noise and thereby provide greater general protection for the public, so the Land Compensation Act, 1973 (and the Noise Insulation Regulations made under it) has made a significant step forward in providing for the compensation of people whose homes are affected by noise from new roads. Grants for carrying out works of noise insulation are payable under the act by Highway Authorities if the levels of noise outside houses are significantly raised by increased traffic due to new or altered highways. Eligibility for compensation depends on an L10 assessment which means in effect if the noise affecting the premises exceeds 68 dB(A) for more than 10 per cent of an observation period of 18 hours. If the level prior to works was above 68 dB(A) then an increase of 1dB(A) is sufficient to make for elegibility. Measuring techniques are laid down in the regulations and as with the other legislation outlined here should be consulted on points of detail.

NOISE AND NOISE MEASUREMENT

Noise has been defined in a variety of ways but perhaps the best and simplest definition is "sound unwanted by the recipient". Today it is recognised as a major environmental pollutant, responsibility for the the control of which falls mainly to local authorities.

The Decibel

The unit of noise measurement is the decibel which is a logarithmic ratio of the sound pressure created by the noise source and a sound pressure of 0·00002 N/M^2 which corresponds to the threshold of human hearing.

It can be represented thus:

Value in decibels = $20 \log_{10}$ P1
—
and PO

Where P1 = the sound pressure given off by the noise source.

and PO = 0·00002 N/M^2 (lowest sound pressure level detectable by the keen young human ear)

The decibel scale only takes account of sound pressure. However, there are many other factors which contribute towards the creation of annoyance on the part of the recipient. These are for instance, the time of day, any association which the noise excites, any significant impulse characteristics of the noise and most importantly the range of frequencies involved.

The human ear is sensitive only to certain frequencies. This is known as the audio frequency range and it spans from about 20Hz to 20,000Hz for young people, with the upper limit being reduced to 10,000-12,000Hz for older people. Within this range aural sensitivity is not a linear function, in that the ear is relatively insensitive to low frequency noise, but increases with pitch to a peak at around 2000-4000Hz before gradually falling away again in the higher levels of the audio frequency range. In other words the frequency of a sound contributes to the subjective impression of its volume or loudness and it is the combination of sound pressure level and frequency that is the most common basis for assessment of annoyance.

Frequency Weightings

As a result "weighting" networks have been built into sound level meters which are referred to by the symbols dB (A), dB (B), dB (C) and dB (D). They attempt to simulate electronically the subjective interpretation of noise by the recipient. The "A" weighting results in extra attenuation at low frequency, decreasing as frequency increases and at around 2000Hz "adds" to the noise. It can be regarded as an annoyance scale and of course is the scale most frequently used in general noise survey work, because it most closely correlates frequency and sound pressure (over the audio frequency range) to subjective response. The other weightings "B" and "C," which are included on most meters, correspond to equal loudness contours of 70 and 100 phons (a phon is a unit of loudness used in measuring intensity of sounds) respectively, and are not commonly used for ordinary survey work, whilst the "D" weighting is used for the assessment of noise caused by aircraft.

The Sound Level Meter

A sound level meter is basically a voltage amplifier and consists of a microphone, an amplifier, a weighting network, another amplifier and a readout device. There are several types of microphones, but the two most commonly encountered are the ceramic or crystal microphones and the more expensive condenser microphone. Both of these microphones can be used away from the meter on extension leads up to distances of about twenty feet with the ceramic type and nine feet with the condenser microphone, dependent of course on the equipment to which it is coupled. It is possible to extend the microphone from the meter to greater distances, provided a microphone pre-amplifier is used. Some models of precision sound level meters have detachable pre-amplifiers which enable the microphone to be coupled directly to this necessary amplification set many yards away from the instrument. The crystal microphone works due to Peizo-electric effect. It contains a small Peizo-electric crystal, which has the property of generating a voltage when compressed. A useful model is to imagine the crystal to be in contact with a diaphragm, which when subjected to extra air pressure due to noise, would be compressed. The voltage emanating would depend on the degree of comparison which in turn would depend upon the strength of the presure wave. With the condenser microphone the function is different. A condenser is basically two plates separated by a dielectric (air). The amount of charge held, i.e. its capacity, depends upon the distance between the two plates. If the diaphragm constitutes one plate and is subject to pressure, it will obviously bend inwards, thereby altering the capacitance of the microphone to an extent depending upon the incident wave. In both cases a varying electrical signal is picked up by the amplifiers and ultimately displayed as a readout. Neither the condenser microphone nor crystal microphone should be exposed to dampness or conditions of very high humidity and for outdoor use a wind shield should be used.

Calibration

It is essential that all equipment can be calibrated and checked very frequently. Acoustic calibrators are essential items of equipment and a number of types are readily available such as the "Pistonphone" and "Falling Ball" models. A sound level meter can, provided it has an output socket, be used to feed the noise signal being observed into a tape recorder.

Use of Tape Recorders

This system of measurement is used throughout the world and allows the recording of the noise to be subjected to later analysis of a type more detailed than can be made in the field. This technique is adopted for the accurate measurement of road traffic noise, or other noises when it is desirable to analyse them carefully into ⅓ octave or narrower frequency bands. In the latter case this can provide a great deal of useful information about the noise source, as well as acting as a guide to the appropriate remedy.

Measurement Technique

The basic equipment for this technique to be used is then:—

1 A precision sound level meter.

2 A Calibrator.

3 A high quality portable tape recorder.

This "set up" constitutes the measuring system. The technique is to (i) couple the meter to the recorder, (in this capacity the meter is acting only as a microphone), (ii) The meter is switched on and allowed to warm up for about thirty seconds. (iii) The tape recorder is switched on and set to record. (iv) A calibration signal from a piston-phone or Piezo-electric calibrator is fed into the meter and the sensitivity of the tape recorder set. (It is very important that the sensitivity of the recorder is not altered after receiving the calibration signal). (v) Having inserted the calibration signal the "set up" with the meter attenuators left on 90 dB, would record all noise from roughly about 50 dB to 100 dB (i.e. the dynamic range of the tape recorder).

If the meter attenuator was turned down to 70 dB one would pick up the range of noises from around 30 dB to 80 dB. The system is adjusted to measure the required range by setting the meter attenuators and it is important to state what attenuation is being used for the recording. As stated earlier the meter acts solely as a microphone and the needle on it is ignored. Analysis of the tape is done by using, in the case of traffic noise, a high level recorder, and a statistical distribution analyser. If narrow frequency band analysis is required, then a narrow band analyser is used in conjunction with the high speed level recorder. In most cases however, noise complaints from industrial sources can be adequately investigated with a precision sound level meter, a calibrator and an octave band filter set. Instrumentation does not enable one to assess noise nuisance more effectively, but does provide for cross-checks against recognised standards of community reaction, such as comparison with B.S. 4142 (1967), the Wilson Standards, ISO Noise Rating curves etc., and introduces an air of complete impartiality.

Noise Assessment

The procedure laid down in the British Standard could be briefly summarised as follows:—

i Set up the sound level meter 12ft 0in from the wall of the dwelling (or other reflecting object) and check the meter batteries and its accuracy using a calibrator. The microphone is pointed towards the noise source and is protected by a wind shield. The "A" weighting is utilized and the meter response is set to the **slow** response. (Sound level meters have a fast and slow function which affects the indicating needles' response.)

ii If the offending noise is temporarily absent, note the background or ambient noise level.

iii When the noise occurs one measures the Sound Level, the duration of the noise and whether it is of an impulsive nature or possesses tonal characteristics.

iv When the observations are completed one makes alterations to the measured noise level (iii above) in accordance with the standard i.e. if the noise is of an impulsive nature, or has a tonal characteristic, it is known to be more annoying and a 5 dB(a) penalty is added. Corrections are also made for Intermittency whether it occurs by day or night. The resultant figure is known as the corrected noise level, and if the difference between the background of the corrected noise level exceeds 5 db(A) one normally regards action as being necessary. The operator should refer to the standard, a copy of which is obtainable from B.S. Institution, Park Street, London. The standard also contains criteria which can be used if the background noise level cannot be established and comparison is then made between the Corrected Noise Level and the Corrected Criteria (i.e. corrected for type of district etc.,). Having ascertained that a nuisance exists one must now secure its abatement and here proper and adequate instrumentation can serve to indicate possible remedies.

Noise Insulation and Absorption

Confusion often arises between sound insulation and sound absorption. Sound absorbent materials alter the acoustic character of a room, but do not have any effect on increasing the sound insulation value. If one considers a room in an empty, unfurnished house, any noise generated sounds hollow and reverberant. Once absorbent materials are introduced, such as soft furnishings, the reflections of sound which previously caused reverberation are reduced. It follows that sound absorbent treatments basically alter the acoustic character of a room. Consider a room the wall surfaces of which are bare plaster. If a noise source were placed in this room the sound heard would be comprised of the direct noise from the source plus the reflected (reverberant) sound bounced back from the hard surfaces. There are therefore, two components making up the total noise heard. It is possible by the use of sound absorbent materials in the walls ceilings etc., to reduce the reverberant component and this has the effect of lowering the sound level within the room. The major component is now the noise emanating directly from the source and is not the summation of the two components. A reduction of more than 10 db(A) through an absorbent treatment would not be likely, although it must be remembered that the quantity of sound absorbed by any material depends on the frequency of the incident noise.

The introduction of sound absorbent material lowers the noise in the room, but does not alter the direct noise from the source, and does not significantly alter the insulation value of the structure.

If one were to enclose a noise source at present in the open with a sound absorbent material, there would be very little effective difference in the measured sound level, due to their low mass. On the other hand if one were to enclose the source with a 4½in brick wall (plastered) and cover it with a substantial roof an improvement of the order of 45 dB would result.

The average insulation value of 4½in plastered brickwork is 45 dB and the insulation value is frequency dependent. Every time the frequency of the incident sound to doubled the insulation value of the material increases by approximately 5 dB. When insulation values are quoted for different materials, they are usually the average of the time values between 100 and 3200 Hz. As a rule of the thumb the average insulation value approximates the time value at 500Hz.

Sound Absorption although a useful aid to good insulation cannot be used alone as a substitute for it.

There are several factors which determine how effective a material will be as a sound insulation. First weight—increasing the weight of a structure brings about a corresponding increase in its insulation value. e.g. if the mass of a wall is doubled from 4½in-9in the insulation value goes up by 5 dB to 50 dB. This means that by doubling the weight 5 dB has been added to the insulation value. The cellular structure of the materials is also important. To give maximum insulation the insulating material must be non-porous. Other factors of importance are the completeness or uniformity of the structure and the rigidity.

British Standards Relating to Noise

B.S.	
2497	Reference zero for the calibration of pure-tone audio meters, 4 parts (M)
2750	1956 Recommendations for field and laboratory measurement of airborne and impact sound transmission in buildings (M) Amendment PD 5065, October 1963
3045	1958 The relation between the sone scale of loudness and the phon scale of loudness level (M)
3425	1966 Method for the measurement of noise emitted by motor vehicles. Amendment PD 6024, February 1967
3489	1962 Sound level meters (industrial grade) (M)
3638	1963 Method for the measurement of sound absorption coefficients (150) in a reverberation room (M) Amendment PD 5127, January 1964
4142	1967 Method of rating industrial noise affecting mixed residential and industrial areas (M) Amendment AMD 1661, January 1975
4196	1967 Guide to the selection of methods of measuring noise emitted by machinery (M)
4197	1967 A precision sound level meter (M)
4198	1967 Methods for calculating loudness (M)
4675	1971 Recommendations for a basis for comparative evaluation of vibration in machinery (M)
4718	1971 Methods of test for silencers for air distribution systems (M)
4813	1972 Method of measuring noise from machine tools excluding testing in anechoic chambers (M)
5228	1975 Code of practice for noise control on construction and demolition sites (M)
CP3	Chapter III: 1972 Sound insulation and noise reduction. Amendment AMD 1385, March 1974
CP 153	Windows and rooflights. Part 3: 1972 Sound insulation (M)

Note: (M) indicates standards in which the requirements are specified in metric units.

NOTES

SECTION 4

WATER POLLUTION

Page
Water Pollution Control in Britain 88
Treatment of Industrial Effluents 90
British Standards Relating to Water 92

Water Pollution Control in Britain

Background and the Law

For well over 100 years the control of pollution of watercourses has been a matter of concern to the British Government. With the development of modern industry and mass urbanisation early in the 19th century, coupled with the widespread introduction of the water-carriage system about the same time, rivers and streams throughout the country soon became evil-smelling open sewers and a danger to public health. Fish were killed and water made quite unfit for either domestic or industrial use. Diseases and fevers caused by water-borne organisms were rampant; for example, four epidemics of cholera in London between 1832 and 1866 were responsible for 36,000 deaths.

To improve this very unsatisfactory situation the Government in 1857 appointed the first of a series of Commissions to study the problem and explore possible remedies. Methods of treating sewage to prevent river pollution were investigated and found practicable and eventually the Rivers Pollution Prevention Act of 1876 was passed which made it an offence to discharge sewage into an inland watercourse without first making it inoffensive; similar clauses were also included to cover trade effluents. The last commission—the Royal Commission—was appointed in 1898, and during the following 17 years did an immense amount of valuable work. The reports of the various commissions have since formed the basis of the science of sewage purification throughout the world.

The Act of 1876 had placed the responsibility for prevention of river pollution in the hands of local authorities and by 1939 there were some 1600 authorities with powers for prevention of pollution. Because of this diversity of authority, the law was poorly administered and the powers were largely ineffective. There was a general movement of opinion that the river pollution law should be administered by one body responsible for the whole of a river. So it came about in 1948, by Act of Parliament, that River Boards were set up to deal with all river interests, i.e. fisheries, land drainage, navigation, conservation and abstraction of water and prevention of pollution. In England and Wales some 30 Boards were formed and these continued in existence until 1963 when under the provisions of the Water Resources Act 1963 they became River Authorities and at the same time they were given additional functions to those listed above, namely, responsibility for flood prevention and for promoting water resources. River pollution control remained with these authorities until April 1974 when the structure of the water industry in England and Wales was re-organised (see below).

The earlier River Boards continued to administer the 1876 Act, but it soon became clear that the provisions of the Act were quite inadequate for the effective control of watercourses. Accordingly in 1951 new legislation, the Rivers (Prevention of Pollution) Act 1951, came into force. This was strengthened by a further Act in 1961, the Rivers (Prevention of Pollution) Act 1961, and it is under these two Acts that discharges to non-tidal rivers, streams and connected watercourses are controlled today. In introducing these Acts for "maintaining or restoring the wholesomeness of rivers", Parliament recognised and indeed, emphasised, that this was "a process in gradualness" and one which could not be effected over the short term.

These Acts make it unlawful for anyone to make a discharge to a receiving watercourse without the consent of the controlling authority. In granting consent to a discharge, the authority may impose conditions in respect of quality and quantity which can be revised at not less than two-yearly intervals. The Acts also provide for a right of appeal to the appropriate Minister of the Crown against any conditions imposed.

Until the re-organisation of the water industry in April 1974, the responsibility for sewers, sewage treatment and disposal was in the hands of the 1200 local authorities in England and Wales. Their duties in this respect were defined under the Public Health Act 1936 which made them responsible for making "such provisions by means of sewage disposal works as may be necessary for effectually dealing with the contents of their sewers". Industrial effluents, defined as the discharge from any trade premises, may be discharged into the public sewers subject to the consent and conditions imposed by the responsible authority. These powers are allowed under the Public Health (Drainage of Trade Premises) Act 1937 strengthened by the Public Health Act 1961, which permit the authority to apply quality and quantity conditions on the trade effluents discharged. With these controls the authority is able to protect its sewerage system from substances which are harmful to man, the sewerage system, the treatment works, and hence the receiving watercourse. At the same time these Acts allow the authority to recover from traders the costs incurred for the conveyance, treatment and disposal of industrial effluents. Provision is also made for appeals to the Minister against a refusal of consent or against conditions to be imposed including charges levied.

The Regional Water Authorities, 1974

During recent years it has become evident that in order to meet the increasing requirements for water in England and Wales, a strong administrative structure would be required, which not only controlled pollution but also planned and integrated policies for the whole water cycle. The system of divided responsibility between local sewerage authorities (1200 in number), river authorities (30), together with water undertakings (160) had certain weaknesses, the main one being that their respective interests often conflicted with the best overall solution.

Accordingly, after much discussion, the Government decided to bring together under single "multi-purpose" management structures, all aspects of the hydrological cycle. Thus, under the Water Act 1973, ten Regional Water Authorities were established as from April 1974, to take over and integrate the functions of the former several statutory bodies. In addition to enforcing the pollution control legislation (referred to above), the duties of the new authorities are extended to include environmental and aesthetic considerations. Thus in carrying out their functions they are to have regard to the preservation of natural beauty, the conservation of flora and fauna and features of scientific interest, and the protection of buildings of architectural value and public rights of way. The Act recognises the amenity and recreational value of water space and requires the authorities to provide, wherever practicable, for public access to, and utilisation of, the amenity. The Act is very comprehensive and it is hoped that the Water Authorities will be able to take a perceptive and futuristic view of water resource management coupled with an increased awareness of environmental and amenity considerations.

The Control of Pollution Act is designed to consolidate the existing legislation while extending the powers for pollution prevention to cover all waters within territorial limits. Pollution sources such as disused mines and accidental discharges are also brought under control. The penalties for infringements of the regulations are increased considerably; to a maximum of two years imprisonment on conviction on indictment. It is anticipated that the new legislation and the re-organisation of the administrative authorities will result in a considerable further improvement in the quality of our inland and coastal waters, together with a responsible attitude towards water resource utilisation and conservation.

Disposal of Sewage and Liquid Wastes

Clean natural water in a watercourse is normally well-oxygenated and contains a large and varied number of life forms, including protozoa, bacteria and aquatic plants and animals, forming a complex system and keeping the stream in a healthy condition.

Pollution of a watercourse may be defined as the destroying or modifying of the life in such waters and/or the reducing of the purity of such waters so rendering them foul or filthy. Such pollution is primarily attributable to the addition of waste waters (such as sewage) which contain large quantities of suspended solid matter and oxygen-consuming organic materials. The effects on a receiving water are such that the natural dissolved-oxygen level is depressed owing to its absorption by bacteria in the presence of the organic matter. If the organic pollution load is sufficiently great, the stream may lose all its dissolved oxygen, when putrefaction, and foul odours, due the to liberation of hydrogen sulphide, ammonia, and mercaptans, result. The general overall effect is to diminish or destroy the general amenity and recreational aspects of watercourses which are the main source of supply of water for domestic and industrial purposes.

Sewage may be defined as "the liquid wastes (domestic and industrial) from a community". The object of water pollution control is to allow these liquid wastes to be carried to the sea without preventing the use of the waters into which they are discharged for the many purposes for which they are required. It is thus clear that a very wide range of interests is involved, and the effluent standard required will differ from one situation to another.

For discharges to inland rivers, streams, etc., no common standard has been fixed by statute because the character and use of rivers vary so greatly. The controlling authorities are expected to impose, and to justify, consent conditions with the particular conditions and uses of each stretch of river in mind. For example, rivers used for public water supply will in general require effluents of a greater quality than those not so used.

In 1908 the Royal Commission (referred to above) proposed a general standard for sewage effluents of no more than 30 mg/l suspended solids content and 20 mg/l biochemical oxygen demand (BOD)—a 30:20 effluent. In recommending these standards, the Commission envisaged that the effluent would be diluted with at least 8 volumes of clean river water, and that under these circumstances no problems would result. Although a 30:20 effluent is still the normal minimum requirement of river authorities for sewage effluents in the majority of situations, this is mainly because such an effluent is reasonably stable and experience has shown that such a standard can generally be achieved readily and consistently by modern methods of sewage treatment properly applied. Since the work of the Commission however, a great deal of knowledge has been gained, and continues to be gained, about the chemistry, bio-chemistry and biology of rivers and the requirements and functions of aquatic fauna and flora. It is quite plain that the condition or wholesomeness of a river does not depend on the quality of its effluent content alone, but also on such factors as gradient, depth, rate of flow, presence or absence of weirs, and the character of the river bed. They determine, together with dilution, the amount and quality of effluents that can be received without sacrificing wholesomeness. Thus in this country, individual standards for individual effluents are regarded as the modern requirement.

Conventional sewage treatment processes are thus basically designed to remove gross pollution only, i.e. oxygen-consuming (including ammonia) and sludge-forming matter. Production of a 30:20 effluent represents a removal of these constituents from sewage of between 90 and 95 per cent. This amount of purification is achieved traditionally by a two-stage process—sedimentation to remove settleable solids and biological treatment to convert dissolved and colloidal organic matter to gaseous and cellular matter. This bio-oxidation is a complex process and may be achieved by the use of either biological filters or by the activated sludge process. The cellular sludge produced in these processes is removed by further settlement for subsequent treatment and disposal; several alternative methods are employed for the treatment of sludge including digestion in the absence of air, air-drying on open beds, and mechanical drying using centrifuges, filter presses, vacuum presses, etc.

In Britain today there are some 5000 sewage treatment works employing biological processes and serving about 85 per cent of the population—a percentage very much greater than obtained in any other country. These works vary greatly in size from those dealing with a few hundred cubic metres of sewage per day to those treating over 100,000 cubic metres per day. The populations served by the two biological treatment processes, filters and activated sludge, are about the same.

On average about half the flow of sewage received at treatment works is composed of industrial effluent. In round figures this amounts each day to 6·8 mil m^3 which with some 7·3 mil m^3 of domestic sewage, makes a combined total flow of 14·1 mil m^3 or about 280 litres per person per day. It has been estimated that the volume of water used is rising at the rate of about 3 per cent per annum; the volume of sewage is consequently increasing at about the same rate.

Total expenditure on sewerage and sewage treatment currently amounts to rather more than 0·5 per cent of the gross national product, compared with a figure of about 0·4 per cent in 1961/62. In monetary terms the capital expenditure on sewerage and sewage treatment has increased from about £20 million in 1950, to £50 million in 1960, to £115 million in 1970, and to £160 million in 1973. The effect of this increased investment in recent years has resulted in a significant improvement in the overall condition of rivers in the country, despite the increasing volume of effluents discharged to them and the occurence of new problems arising, for example, from the increasing ues of new chemicals by industry and in the home.

TREATMENT OF INDUSTRIAL EFFLUENTS

Introduction

Industry uses large quantities of water for a variety of processes. For example, for the production and processing of one tonne of coal up to 1,500 litres of water are required; for one tonne of paper 90,000 litres; for one tonne of viscose staple fibre 136,000 litres; and for one tonne of steel 200,000 litres. In the chemical industry consumption varies widely for each product, and one tonne of a chemical produced may require up to 900,000 litres of water. The waste waters produced by industry are termed 'trade effluents', and are discharged to local authority sewers, to watercourses or to the sea. Under existing legislation 'trade effluent' has been defined to include wastes from farms and from research or experimental establishments. Discharges to sewers are controlled under the Public Health (Drainage of Trade Premises) Act 1937 and the Public Health Act 1961 (Part V); to rivers under the Rivers (Prevention of Pollution) Acts 1951 and 1961; and certain discharges to estuaries under the Clean Rivers (Estuaries and Tidal Waters) Act 1960.

On average about half the flow of sewage arriving at municipal treatment works consists of trade effluents. This amounts to about 6·8 M m^3, and in addition a further considerable flow of trade effluent is discharged directly to watercourses or to the sea either with or without pre-treatment.

Classification and Characteristics of Trade Effluents

Trade effluents have been broadly classified into five categories as follows:

(i) Effluents from food and drink manufacture.

Wastes from these industries contain certain natural organic compounds such as carbohydrates, proteins and fats, frequently in quite large concentrations. The wastes are therefore of high oxygen demand. Many of the waste waters arise from washing of equipment, vessels, etc. and the effluents therefore contain all material remaining in the equipment along with certain detergents. For example a survey of milk distribution depots has shown that the amount of milk discharged in waste waters is of the order of 0·2% of the throughput of milk.

Polluting waste waters from breweries similarly result from the washing of vats, coppers and bottles. Contamination must clearly be avoided at all stages of the brewing process, and large volumes of water are therefore used in washing to which are added various detergents. The volume of waste waters from a brewery may be as high as 10 litres per litre of beer brewed.

Throughout the food industry the obvious need for cleanliness requires that large volumes of water be used for washing purposes. The preparation of fruit and vegetables for drying and canning involves thorough washing at various stages and certain chemical treatment processes. Large volumes of water are also used in keeping both equipment and floors thoroughly clean.

(ii) Effluents arising from processes using raw materials that are animal or vegetable matter.

Such industries include the paper, leather and wool industries. Complex polluting effluents are discharged from the three main processes in the manufacture of leather viz. tanning—treatment of prepared skins, fellmongering—removal of wool from sheep skins and preparation for tanning, and leather dressing—retanning and finishing.

Tannery operation involves a number of processes including soaking, liming for hair removal, deliming, tanning and finishing. The waste waters therefore contain extremely large amounts of biologically oxidisable material (e.g. proteins) and putrescible solids. In addition, lime and certain other chemicals used in the removal of hair are present as well as the vegetable extracts or salts of chromium used in the tanning process. The other leather manufacturing processes similarly result in wastes of high oxygen demand also containing various chemicals.

The wool and textile industries also involve the discharge of grossly polluting effluents, but the pollution may be greatly reduced by pre-treatment processes, and these are often used even if the effluent is discharged to the public sewer. The washing (scouring) of wool removes large amounts of mineral and vegetable matter which clings to the wool. The resulting liquors are thus grossly polluting, but contain large amounts of grease and potash which may be recovered economically.

(iii) Farm wastes.

When animals range freely and farms are relatively isolated pollution of streams by agricultural wastes is not normally a problem. However, with the advent of intensive rearing units the problem has become considerably greater.

Large animal units are concentrated in certain areas of the country, and may not have sufficient land for manure disposal. This has resulted in the practice of dilution of the animal excreta with water to form a slurry, which may then be pumped or tankered onto land. However, many soils are heavy clay, and vehicle access may be diffiult in wet conditions. Distribution of slurry by seepage or percolation into surface or underground watercourses may also be a public health hazard by spread of bacterial, parasitic or viral diseases since slurry is not subjected to the self-sterilising effects of composting. Certain growth-stimulating chemicals are added to animal diets, and residues from these substances may lead to problems in disposal. This is particularly important with regard to the recent innovation of drying poultry manure as a foodstuff for cattle and sheep. Some farmers dispose of slurry to municipal sewers, but on a national scale this would be totally uneconomic.

Crop wastes such as grass silage are extremely polluting, and pesticides and insecticides (e.g. plant sprays, sheep dip, container washings) cause problems. In particular there is not at present a totally satisfactory means of sheep dip disposal.

The problem associated with the treatment of effluents of these three classes containing organic compounds of natural origin is normally one of capacity and not of method, and the unit processes used in their treatment are similar to those at sewage treatment works. This is not the case however for trade effluents of the remaining two types, those from the metal and chemical industries.

(iv) Effluents containing metal and cyanides.

Such effluents arise mainly in the engineering industries from processes such as pickling and electroplating. The amounts of biodegradable material contained in these effluents are small, and the biological processes play only a limited part in their treatment.

When iron or steel is heated a scale of iron oxides is formed on the surface, and in most cases this scale must be removed. Removal is frequently carried out by pickling in a solution of sulphuric or hydrochloric acid. The steel is then washed with water, and thus two waste waters are involved. The first is the spent pickle liquor, which is discharged only intermittently, if at all, and contains sludges of iron oxides, iron salts and the free acid. The wash water is discharged continuously, and contains pickle liquor considerably diluted.

Volumes of pickle liquor wastes discharged to municipal sewers must be strictly controlled since they can have serious effects on sewage treatment works operation. In addition difficulties may arise from corrosion of sewers due to free acid and sulphate. Treatment with lime may be used to neutralise the free acid and precipitate iron and sulphate as insoluble iron hydroxides and calcium sulphate.

Similar wastes containing chromium (as chromate) arise from chromium plating processes. Chromium is toxic to the sewage treatment processes, and wastes are sometimes treated with barium chloride and sodium carbonate to precipitate insoluble barium chromate.

In electroplating metals such as cadmium, copper and zinc are deposited from alkaline solutions of complex cyanides of the metal. The strong plating solutions therefore contain large amounts of cyanide, but are discharged only very infrequently. However, after plating the articles are washed with water, and these waste waters contain the same materials as the plating solution but in much smaller concentrations. Cyanide is highly toxic to the sewage treatment processes and disposal of cyanide solutions must therefore be strictly controlled. Cyanide may be converted to the less toxic cyanate by chlorination or treated with ferrous sulphate and lime to form complex insoluble iron cyanides.

(v) Chemical Effluents—mainly from chemical industries and those industries using chemicals.

This class of waste is probably the most diverse ranging from pharmaceuticals and fine chemicals to oil refining and petrochemicals and probably contains the most difficult effluents.

Few chemical reactions result in the exclusive production of the required product and, as a result, many chemicals are produced as by-products. Thus the volumes and nature of wastes from a chemical complex are rarely consistent and further difficulties are introduced by the batch nature of many processes, some even on a seasonal basis.

Some complex organic compounds such as pesticides are toxic in small quantities to biological purification, and may be only partially removed at a sewage treatment works. Similarly some pharmaceutical products are bactericidal, and may not be completely removed. The discharge from a sewage treatment works accepting wastes containing such compounds may therefore contain certain residues which, while not present in harmful concentrations, may enter the food chain and thus be concentrated.

The most serious problems in trade effluent treatment arise from the discharge of toxic effluents such as some of those of classes (iv) and (v). Without sufficient care breakdown of sewage treatment processes can result leading to fish deaths in receiving waters. Sub-lethal concentrations of certain compounds may also render water unsuitable for potable supply.

British Standards Relating to Water

B.S.		
756	1952	Dean and Stark apparatus. Condensers and graduated receivers for determination of water content by this method. Amendment PD 1778, December 1953 (M)
879	1964	Water well casing. Amendments PD 6015, February 1967; AMD 41, August 1968; AMD 1490, July 1974
1170	1968	Methods for treatment of water for marine boilers.
1328	1969	Methods of sampling water used in industry (M)
1427	1962	Routine control methods of testing water used in industry. Amendments PD 5807, March 1966; PD 6063, March 1967; PD 6344, January 1968
1438	1974	Media for biological percolating filters (M) Amendment AMD 998, August 1972. Single sized materials 63mm to 14mm, for treatment of water, sewage and trade effluents.
2486	1954	Treatment of water for land boilers.
2690		Methods of Testing Water Used in Industry.
	Part 1: 1964	Copper and iron (M)
	Part 2: 1965	Dissolved oxygen, hydrazine and sulphate (M)
	Part 3: 1966	Silica and phosphate (M)
	Part 4: 1967	Aluminium, calcium, magnesium and fluoride. Amendment AMD 227, March 1969 (M)
	Part 5: 1967	Alkalinity, acidity, pH value and carbon dioxide (M)
	Part 6: 1968	Chloride and sulphate (M)
	Part 7: 1968	Nitrite, nitrate and ammonia (free saline and albuminoid (M)
	Part 8: 1968	Cyclohexylamine, morpholine and Inog-chain fatty amines (M)
	Part 9: 1970	Appearance (colour and turbidity), odour suspended and dissolved solids and electrical conductivity. Amendment AMD 1012, August 1972 (M)
	Part 10: 1970	Sodium, potassium and lithium (M)
	Part 11: 1971	Anionic, cationic and non-ionic detergents and oil (M)
	Part 12: 1972	Nickel, zinc, chromates and total chromium and manganese (M)
	Part 13: 1972	Dichrometer value (chemical oxygen demand), non volatile organic carbon, tannin and chlorine (M)
	Part 14: 1972	Arsenic, lead and sulphide (M)
3680		Methods of measurement of liquid flow in open Channels.
	Part 1: 1964	Glossary of terms.
	Part 2A: 1964	Dilution methods. Constant rate injection.
	Part 2C: 1967	Dilution methods. Radioisotope techniques (M)
	Part 3: 1964	Velocity area methods.
	Part 4:	Weirs and flumes.
	Part 4A: 1965	Thin plate weirs and venturi flumes.
	Part 4B: 1969	Long base weirs (M)
	Part 5: 1970	Slope area of estimation (M)
	Part 7: 1971	The measurement of liquid level (stage) (M)
	Part 9:	Water level instruments.
	Part 9A: 1971	Specification for the installation and performance of pressureactuated liquid level measuring equipment (M)
4385	1969	Determination of water content of petroleum products (Dean and Stark method)
CP 310		Water Supply. Amendment AMD 665, December 1970

Note: (M) indicates standards in which the requirements are specified in metric units.

SECTION 5

POLLUTION OF THE LAND

Page

The Throw-Away Age 94

Economics of Wastes of Hazardous Content 95

British Standards Relating to Waste 97

Pollution of the Land

The Throw-Away Age

by S. Cayton, M.B.E., C.Eng., M.Inst.F.

The ice-age, the stone-age, the bronze-age and the iron-age have been so called to describe significant periods of history. We deceive ourselves if we imagine for one moment that "Atomic age" or "Nuclear age" is a likely epithet for our own times. An age which tolerates the cutting down of forests of trees which have taken fifty and more years to grow, converts them to wood pulp and then discards the resulting paper made up in a hundred different forms, to litter the countryside, town and village streets, without a backward glance, is much more aptly described as "The throw-away age".

Industry and commerce have always been concerned for the availability of raw materials be they oil, base metals, precious or semi-precious metals or even diamonds; but until now new sources, when needed, have always been found. In recent times two things have changed this comfortable state of affairs. The conquest of the major diseases of the world has led to the rapid growth of population, especially in the developing countries. Simultaneously, the industrialised nations have found ways and means of producing manufactured goods so cheaply that many more of the world's people have become consumers. The growing millions in the Third World are eager for their share of these products which are so often derived from raw materials animal, vegetable or mineral, which originated on or under their own virgin soil.

The search for new sources of raw materials has temporarily slackened, but as soon as demand revives, prospectors of all kinds will be spurred to greater efforts. Before renewing this feverish search would it not be profitable to direct our energies towards making better use of what we have? To re-use as many things as possible in the same or a different form? In a word, "recycle" instead of "discard".

Not so many years ago a test-piece for a would-be office boy was sometimes the opening of a parcel, neatly wrapped in brown paper and tied with string. It was considered praiseworthy to untie the string, bundle it and fold the paper—both ready for re-use. Today string has given way to plastic tape which is irrecoverable and often makes the paper so, too. Fortunately, people are beginning to question the necessity for elaborate packaging which, in some cases, costs as much or more, than the article being packed. Self-preservation is also prompting makers of packaging to seek ways of guiding sorters of discarded containers and wrappings to ensure the economic recovery of that which is suitable for repulping or, in the case of plastics, reforming by heat.

There is nothing new about recycling especially in the metal-using industries where lead, copper, tin, brass, and old iron have long been regarded, in London in particular, as legitimate 'perks' or 'tat' which refuse collectors daily sort from dustbins and return to the furnaces by way of the scrap metal merchants. Elsewhere, metals are the main sources of income for the so called 'rag and bone' men. Will today's high prices for some of these things be an incentive to revive the occupation of 'rag gatherers', 'refuse picker' or 'bottle washer?' For decades such occupations have been regarded as too filthy and degrading to be encouraged by enlightened employers such as district councils who, for 100 years have been responsible for removing and disposing of everybody's 'trash'—an Americanism but, for once, a more descriptive word than 'refuse'.

Urged on by high prices for imported raw materials and anxiety about suppliers, the U.K. research workers at Warren Spring Laboratory, Stevenage, have a better approach than hand picking of everybody's refuse, 18 million tonnes of it, annually, searching for filthy rags and woollens, bottles, jars, paper and empty food cans. Ferrous metals, it is true, are usually extracted by magnetic separators but the markets for all these salvaged materials are volatile and profitability is seldom sustained long enough to recover the capital cost of the necessary handling equipment.

What then is the alternative to

(a) Separation and incineration of refuse and hand-picking of re-usable articles off a moving conveyor belt, or
(b) Direct incineration which is costly and a major sour ce of air pollution, or
(c) Pulverisation which produces far more compost-type material than agriculture and horticultre together can utilise, or
(d) Tipping to land which does nothing to assist the recovery of anything in the refuse which may have some remaining usefulness?

As the source of much of the original research which has made the U.K. pre-eminent amongst the industrialised nations of the world in matters concerning the control and reduction of air pollution, it is appropriate that Warren Spring Laboratory has developed a pilot scale unit to investigate and develop the treatment of total refuse by pyrolysis. In this process refuse passes by gravity through a tube of silicon carbide eight inches in diameter. The tube is externally heated and the pyrolised residues are collected under water at the base of the reactor.

Gases formed in the process pass out of a side arm and subsequently through a trap-door and scrubber. The gases are then stored in a gas holder and used on the plant to supply heat for the process or for other purposes.

The process has the advantage over traditional methods of refuse incineration in that it does not create any pollution problems including those of offensive odours. The gases evolved in the furnace do not carry significant quantities of solids to the scrubber and acidity is neutralised by the ammonia produced in the decomposition of the vegetable matter in the refuse.

In addition to the production of gaseous fuel the residual solids can be treated for the recovery of ferrous and non-ferrous metal.

Estimates of capital and operating costs have yet to be made, but it has been suggested that costs are not likely to be higher than for incineration as currently practised. Considering that in terms of heat and metal content it is estimated that the national ouput of domestic refuse can be valued at about £500 million annually, this is an exciting and stimulating project. Particularly is this so if industrial refuse is added which is usually considered to be at least equal to the annual weight of domestic refuse. Previously, industrial refuse was something the local authorities' refuse collection services sought to avoid but it is now firmly within their responsibility; and when full-scale plants for the pyrolysis of refuse are developed, industrial and commercial refuse may be very advantageous to their economic operation.

The contents of every householder's dustbin and the bulky items too big for the dustbin, such as large toys, washing machines and refrigerators are immediately thought of in any consideration of recycling. Seldom, if ever, when we gloomily contemplate a wet Saturday afternoon, do we realise that rain is a complete example of recycling. It falls from the clouds run down to the sea, is drawn up where the atmosphere is warmer and drier and then blown over the hills to fall again, as rain.

We take our water supply for granted and expect unlimited supplies as soon as we open a tap. To a large extend we squander it regardless of where it comes from or where it goes . Consumption for domestic, industrial and commercial use goes up year by year. In contrast, every new project to build new reservoirs and impound water is the subject of bitter controversy. Environmentalists complain of the loss of amenities, for scenic grandeur is frequently seen in the wettest parts of Britain. Some again, deplore the submerging of villages, farms and agricultural land whilst others criticise the Water Authorities for extravagance and financial irresponsibility.

A conservationist Society such as The National Society for Clean Air might argue very forcibly that much more water could be extracted from our major rivers and even the canal system which serves the industrial and built up areas. This means a big clean-up to remove solid and liquid pollution from all waterways. Many large rivers are made unsightly and dangerous by the dumping of rubbish into their waters. To deal with solid pollution of this kind is relatively easy compared with liquid effluents such as untreated sewage and more particularly, the toxic metallic discharges which reach the river from industrial plants conveniently situated.

Water pollution by sewage and toxic liquids is as insidious as pollution of the air by toxic gases and equally deleterious to the environment in town or the countryside.

The prevention of river pollution by toxic chemicals such as mercury, cadmium and many others may be just another exercise in recycling of the toxic solutions to recover the value in the metals, recoup at least some of the cost of the operation and achieve at the same time a cleaner effluent. The photographic industry is an example. Silver is being recovered from the liquor in the film developing tanks which formerly all went down the drain.

Industrial development requires a minimum of about five gallons of water every day for each kilowatt/hour, of power production. Water is recycled for us by a bountiful nature. To make and keep it clean is an objective worthy of our Society.

Economics of Wastes of Hazardous Content

In 1972 the Deposit of Poisonous Waste Act established, for the first time in our legislation, the offence of causing or permitting an environmental hazard by depositing waste on land. Managements had perforce to assess their wastes and methods of disposal and, as a result, reclamation increased, probably by 50 to 100% in the case of solvents, non-ferrous metals and acids[5]. The added incentive also existed that the Act was intended as an interim measure, to be followed by further legislation of a more comprehensive nature, possibly introducing stricter control.

The Health and Safety at Work etc Act 1974 followed. This places obligation on every working person with regard to the disposal of toxic waste. Whereas the 1972 Deposit of Poisonous Waste Act refers to solid, semi-solid or liquid, the 1974 Act is of particular relevance in relation to the emission of toxic gases. In the case of solvent emissions, for example, recent work on codes of practice has brought together considerations of threshold limit values[6].

The Control of Pollution Act 1974, when fully implemented, will bring together and extend the powers for the control of all wastes, solids, liquids and gases. However, the current need to keep public expenditure to a minimum means that implementation of many of the provisions in this Act have been deferred.

Almost all solid and semi-solid toxic wastes are disposed of by tipping, with minor quantities being discharged to the sea or incinerated[5]. Gaseous wastes are discharged to the air with appropriate dilution or, where profitable or necessary, reclaimed by standard recovery techniques or incinerated.

Typical of the thinking in industry is a recent case study of alternative methods of passing highly toxic waste to the sea. One method took diluted washings of the waste chemicals to the local authority sewer at a cost of some £3,000 per year. An alternative was to estimate the cost of concentrating the toxic materials, to place it in 10-gallon drums which, concreted into 40-gallon drums, could be dumped at sea at a cost of about £6 per drum. The range of considerations is very wide. The 'Report of the Technical Committee on the Disposal of Solid Toxic Wastes'[2] states 'neither impracticable idealism nor disastrous laissez-faire is the right policy to adopt' and it must be remembered that the national bill for the disposal of toxic waste ten years ago probably lay between £1 and £10 million per annum.

The recovery of metals and acidic materials from aqueous solutions can be expensive. For processes to be profitably exploited the throughput must be large or the product must have a high value. Major companies in the chemical recovery business[7,8] have chosen hydrometallurgy as a processing tool because of its selectivity, safety and the ease with which wastes containing similar metals can be processed without major plant alteration. The processes theoretically available are microbial, electrodialysis, ion exchange resins, reverse osmosis, selective electrolysis and solvent extraction and each has its advantages and disadvantages. The common factors are, unfortunately, their high capital cost, inflexibility and sensitivity to fouling or contamination.

Many toxic materials occur in only small quantities but processing plants generally cost less per unit processed the bigger they are. One must often compare the hazard and cost of transporting waste with the cost of processing. Clearly, if the toxic waste arises near a seaboard, the hazard and cost of deep sea dumping may be favoured. Similarly, in coal mining areas the disposal of waste in mines of the right type, subject to proper advice, may be suggested.

With regard to standards for emissions there is little formal agreement as yet even among European nations, but there are indications of a possible acceptance of the threshold limit values originating in the USA and being used by the UK authorities. But it is a difficult path as the European view, with its Napoleonic heritage, does not necessarily coincide with 'reasonable' and 'best practicable means' used with good effect in our own statutes. It is important that we do not penalise our industrial operations by imposing codes and regulations more rigorous than those applied to our overseas competitors, unless there are compelling reasons. On the other hand, agreed European-wide codes could permit cost savings by encouraging a rational arrangement of central waste processing plants.

The value of thinking through waste problems is illustrated by the recycling of a well-known toxic material, lead. Here a number of interesting points arise related to by-products and to unsolved problems.[9] New methods of printing are leading to large tonnages of lead, tin and antimony becoming surplus to the industry's requirements. This metal is a valuable source of solder and antimonial lead, and its processing is an important smelting activity. To remove tin from the alloy the key reaction is with chlorine. The use of scrap polyvinyl chloride has recently been developed to de-tin printing metal and such PVC may be acquired for the cost of transport of the scrap. PVC may itself contain tin and lead in the stabilisers, and this could also be recovered in the same processing. The de-tinned printing metal joins the antimonial lead recycle of lead batteries. Printing metal also contains several ounces per ton of silver, but no economic process for its extraction is yet known. The silver is therefore diluted into the battery lead recycle system beyond all chance of recovery.

Perhaps the present UK situation, as members of EEC and with our backs to the wall economically means that managements will have to pay much closer attention to the way political decisions may affect their operations. The UK has many natural advantages of relatively short fast flowing rivers, wind and rain at all times of the year, and a long coastline with high tidal flow which all can help in reducing the local levels of pollution caused by wastes. We have had a successful history of control of levels of pollution using the 'best practical means' approach. If the policy changes to be one of restricting mass flow of chemicals, which is suited perhaps to the cleaning up of the Rhine, we may be subjected to what has been called a 'policy of equal misery'. Perhaps more weight is needed to support local variations based on threshold limit values at the point where people could be affected by wastes so that we can make full use of the natural capacity of our environment, as stressed previously by the Royal Commission on Environmental Pollution.

With the high capital cost often involved in waste control, even where there is a pay-off eventually, many companies are in difficulties because they just do not have the capital. Changes in main processes of manufacture and equipping to reduce wastes and pollution could involve a time scale of perhaps ten years. It is doubtful if the political scene will encompass tax reliefs for these longer-term requirements; managements may therefore be faced with deciding how the present rules and legislation are applicable during the operational life of existing plant and, most important, how vital is the product to the economy. The price of waste control and whether other areas are equally affected must be taken into account in order that relative competitiveness of the main products is not unfairly altered.

The advent of North Sea Oil may give us an economic breathing space. In the meantime, companies would do well to plan ahead to establish their own base lines on wastes (especially those of hazardous content) employ qualified middle management to supervise operations to meet present requirements and consultants to advise them on the future.

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4. Control of Pollution Act 1974. H.M.S.O.
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British Standards Relating to Waste

.S.

65 Clay drain and sewer pipes including surface water pipes and fittings. Part 1: 1971 Pipes and fittings (M)

416 1967 Cast iron spigot and socket soil, waste and ventilating pipes (sand cast and spun) and fittings.

504 1961 Drawn lead traps. Amendment PD 4448, January 1962

539 1971 Discussion of fittings for use with clay drain and sewer pipes (M)

602 }
085 } 1970 Lead and alloy pipes for other than chemical purposes (M) Lead pipes up to and including 125mm bore (BS 602) and lead-silver-copper pipes in sizes up to and including 40mm bore (BS 1085). Soil, waste and soil-and-water ventilating.

792 1973 Mild steel dustbins (M)

136 1972 Mild steel refuse storage containers (M)

143 1955 Salt-glazed ware pipes with chemically resistant properties. Amendment PD 2869, August 1957

184 1961 Copper and copper alloy traps. Amendment AMD 201, February 1969

577 1949 Mild steel refuse or food waste containers.

1703 Refuse chutes.
Part 1: 1967 Hoppers
Part 2: 1968 Chutes

107 1973 Small incinerators (M). Amendment AMD 1630, January 1975

316 1973 Large incinerators for the destruction of hospital waste (M)

390 Wastes for sanitary appliances and overflow for baths.
Part 1: 1961 Wastes (excluding skeleton sinks wastes and bath overflows). Amendment PD 5634, August 1965.
Part 2: 1962 Skeleton sinks wastes.

456 Safety of household electrical appliances.
Section 2.30: 1971. Food waste disposal units (M)

495 1972 Aluminium refuse storage containers (M)

654 1973 Galvanised steel dustbins for ductless emptying.

B.S.

3656 1963 Asbestos cement pipes and fittings for sewerage and drainage. Amendments PD 6055, March 1967; AMD 322, September 1969

3735 1964 Rubber components for steel dustbins. Amendment AMD 62, August 1968

3813 Incinerators for waste from trade and residential premises. Part 1: 1964 Capacities between 50 lb/h and 1000 lb/h.

3943 1965 Plastics waste traps. Amendments AMD 32, August 1968; AMD 1257, September 1973

4118 1967 Glossary of sanitation terms (M) Amendment AMD 356, October 1969

4324 1968 Litter bins (M)

4998 1974 Moulded plastics dustbins (M)

CODES OF PRACTICE

CP30 1971 Building drainage.

CP302 1972 Small sewage treatment works (M)

CP302
200 1949 Cesspools. Amendment PD 2934, November 1957

CP304 1968 Sanitary pipework above ground. Amendment AMD 187, January 1969

CP305 Sanitary appliances.
Part 1: 1974 Selection, installation and special requirements (M)

CP306 The storage and on-site treatment of refuse from buildings.
Part 1: 1972 Residential buildings.

CP308 1974 Drainage of roofs and paved areas (M)

CP2005 1968. Sewerage.

Note: (M) indicates standards in which the requirements are specified in metric units.

NOTES

SECTION 6

CONSERVATION

Page

Reorganisation for Recovery 100

Environment and Reorganisation 101

ENERGY CONSERVATION

REORGANISATION FOR RECOVERY

The critical situation in which the Nation finds itself in 1976 is being carefully analysed from day to day and from every conceivable point of view.

Such analyses bring forward many diverging solutions and prophesies for the future. Some of these are long term, many are short term but already the process of application of financial restrictions in all branches of the economy is evident. Whatever the correct solution to our problems may be, and only history will judge, the need to curb the rate of inflation as the first step is agreed on all sides. It is the means rather than the end which is the subject of debate.

There is little doubt that whether we succeed in this as soon as planned or not we shall need to reorganise our economy to suit the needs of the future. In providing the social and economic conditions for the future it is clear that industrial, commercial and domestic standards and activities will need to be critically examined.

Familiar as we have been in the past with recurring crises in one form or another it is clear that, in the present circumstances the short term measures and the long term plans must, to a large extent, be carried out in parallel. In this context the effect of our use of energy and its effect on future environmental conditions both inside and outside buildings must be considered.

In all sectors of the energy using scene it is also clear that when money is available little thought is given to renewal, operation, control and maintenance of plant. On the other hand, when, as now, money is in short supply it is required for other purposes which are considered to be more important.

The value of fuel, from which energy is generated, is only realised when the fuel is in short supply. No expense is then spared to obtain standby generators, alternative fuels and the reduction of waste becomes important. More freely available supplies of fuel however allows the attention of the user to overlook these important aspects which are basic to the economic operation of an undertaking. Without a supply of fuel the well being of all is threatened. In conditions where money is scarce, a new supply of fuel is beginning to flow from the North Sea and the short and long term viability of businesses is being threatened it is not surprising that a great deal of talk but little positive action is taking place. Granted that any problem must be fully aired it follows that if quick recovery is to take place, early action is needed.

No single Government or local Government decision can affect all consumers in the same way and, therefore, every case must be considered on its merits.

The fact upon which decisions must be based are:—

1. The fuel is available for winning.
2. The amount available is strictly limited.
3. As world demand increases against a limited supply the price of fuel is bound to increase in the long term.
4. The life of the world's fuel reserves is given by the fuel available÷annual consumption.
5. The life of the world's reserves can only be controlled by the control of fuel consumption.

As the use of energy in some form is a basic necessity of most businesses it follows that everyone must reduce consumption in order to delay the time when fuel resources are exhausted. It is anticipated that the North Sea reserves will, by the turn of the century, be sadly depleted which means that the living standards of many people now concerned with fuel utilisation will be seriously affected by that time, if not before.

Concurrent with these doleful facts are two balancing factors which in themselves could outweigh the disadvantages of facing life under a Damocletian sword.

Firstly the search for the technology to harness the energy from atomic fusion of light elements could, if successful in time, present the world with a completely new and inexhaustible energy source.

Secondly the knowledge that our present methods are wasteful in all sectors from the largest to the smallest fuel user could, if action were taken by everyone concerned, produce more time for the researchers to seek out new energy sources.

It follows that the next twenty five years are crucial to the thinking and actions of all fuel users and, therefore, waste of fuel by inefficient energy generation or utilisation cannot be justified on any grounds whatsoever.

The argument that plans cannot be based on such long term thinking is often heard. Decisions are however taken by people, plant is operated by people. Are these people prepared to say, in their business life, that their pension contributions over the next twenty five years are already written off? Will they accept that the insurance policy they have negotiated will not be worth the payments they are now making?

Twenty five years is not a long time and those who think, like Micawber, that 'something will turn up' should think about what has 'turned up' in the last 25 years!

We have been to the moon, the railway steam loco has gone, so have the great passenger liners. We have Concord for the future. We still argue about district heating and wish that waste heat from power stations could be put to useful service.

We can see things as they happen, when they happen, and in colour too! We are building more nuclear power stations but still we cannot store electrical energy.

It is obvious that the reorganisation of our future must depend upon the scrapping of our fragmented approach to the solution of problems, or even the defining of problems, and a concerted attack on all fronts to the main energy problem must be made.

The first step is to dispense with waste and then ensure that any new systems to be installed can be adapted to take new forms of energy.

Many individuals are heard to say that 'they' can be relied upon. Unfortunately, 'they' are composed of the same individuals who will not obtain any benefits in the future unless they back up their pension contributions with action now to cut out waste as the first step.

ENVIRONMENT AND REORGANISATION

The environmental conditions which exist today are the result of strenuous efforts by our forefathers through the ages. The countryside with its hedgerows, woodlands, parks, neat and well tended fields, has been planned and developed from the forests which covered the country in prehistoric times. Similarly the archaeologist is forever discovering more of the environmental conditions which have been considered amenable inside man's living quarters from the cave to the stately home.

Apart from the unconquerable effect of the elements and certain natural barriers the requirements of society through the ages have been the direct result of progressive improvements in contemporary knowledge of science and the arts.

Our present day environment, whether considered acceptable or not, is not a static condition but is a stepping stone to the future, but, as in the past, progress will be dictated by the resources which are available.

The exterior conditions for the future will depend upon the progress made in obtaining *clean* air from the *clear* air now mainly existing. Noise control is, and will continue to be, a continuance of vigilance and application of new techniques. Architectural features must change with the availability of new materials and must, at all times, distill all aspects of society's environmental demands from time to time. However, the architect and town planner must be in a position to envisage the future in view of the long life of their finished product, the town, the building and the services with which they are provided.

Present day knowledge must therefore dictate, to some extent, the environment of the future just as present day environment is greatly affected by decisions taken in the recent or distant past.

Whilst contemporary technology may produce new materials and methods to give a wider selection of material resources the controlling factor at any stage of decision making is the money available for the project, however large, however small. It should be remembered that money, as such, has no value beyond its intrinsic value and that it is merely a token for goods and services. Whilst there is a school of thought which considers that money values should be 'indexed' to real values there is no doubt that the availability of 'real' resources will be controlled by nominal judgements of value as dictated by money from time to time.

Thus, the future environment must be determined in both long and short term by the present day money value of our resources.

In considering future environment therefore, two factors are of major concern. Firstly, the exterior environment, which is basically provided by climate and, secondly, the interior environment as created by man. The interior environment, however, has great influence on the exterior conditions in that smoke, exhaust gases, effluents of all kinds and the outside appearance of buildings all superimpose man's presence within his surroundings.

A building must be warm inside when weather is cold and cool inside when weather is hot. Fuel must be used to create the conditions so required and this presupposes that exhaust gases be emitted to the atmosphere. The growing needs of man in terms of processed goods demands the existence of factories whose effluents along with those of man himself must be discharged into the outside world. Transportation on air, land and sea affects the environment by emission of similar effluents to the accompaniment of noise and high speeds each of which affect living conditions and life spans respectively.

The common denominator of this superimposed environment is the process of combustion by which energy is generated from a fuel.

The energy crisis which started in 1973, with traumatic effects through the world has precipitated a money crisis which, in turn, has made the need for replanning and rebuilding to be vitally necessary in all spheres of world activity but most particularly in the industrial and domestic sectors of the nation.

The strictures which have been placed upon rebuilding and renewal programmes are well known but some of the environmental advantages are not so well appreciated.

In campaigning for *Clean* Air the first and obvious target was the control of visible smoke and this has, with few exceptions being substantially achieved. However the control of invisible gases is a difficult problem which has been partially achieved at ground level by the 'high chimney' policy. Chimney designs are based on the sulphur content of the fuel to be used. The amount of sulphur-dioxide emitted as the main culprit is dependent also upon the amount of fuel used. For the future there are two important aspects of this problem which appear on the credit side of the balance sheet.

Our supplies of North Sea fuels are substantially lower in sulphur content than other fuels. North sea gas is sulphur free! Therefore, when, and if, these fuels are brought into common use the design of chimneys will be materially affected in terms of height and, in many cases diameter. Over the years the campaign for the more efficient use of fuels has reduced the amount of fuel used for specific purposes so that sulphur emissions have been reduced in proportion. There is a general agreement that present day fuel consumption can be still further reduced by some 15 per cent, on average, and this will play its part in the further reduction of emissions of compounds of sulphur and those of other elements which are deleterious to the environment. It should be remembered however, that increase in demand for fuel will tend to nullify the effect of reduced fuel consumption but so long as the demand is efficiently satisfied then the optimum will be achieved.

Whilst many installations can reduce consumptions, and therefore, emissions at little or no cost there are many plants which may need to be renewed or modified. *Clear* air was mainly achieved by amendment of methods of heating in the domestic sector which in the main was assisted by monetary grants. The possibility that future environmental conditions in all sectors may need to be supported in a similar way may be found to be necessary.

The effect of the higher quality of our indigenous fuels may be seen in new designs of buildings and equipment to take advantage of the reduction in corrosive effect of flue gases due to the reduction of sulphur in the fuels used.

New building standards demanding structures which more effectively retain heat in buildings will from time to time be made and these will result in increased comfort for the same fuel or the same conditions for less fuel.

Petroleum and light distillate fuels from improved feedstock can be expected to produce less noxious emissions.

Political and economic factors have been seen to have startling effects on fuel costs and with a depletion of the world's fixed stock of this commodity it is possible that increased activity will be seen in this area. Whatever may happen to the overall economic condition in other respects it is considered unlikely that fuel costs will fall in comparison to other costs and, therefore all aspects of energy utilisation and conservation must be seriously considered in design for the future.

The search for alternative energy sources is proceeding and with increasing fuel costs the use of solar energy, aerogenerators and heat pumps are worthy of use for new dwellings in particular.

With the severe financial constraints now existing it would seem that the least that can be done is that new buildings should be provided at the outset with facilities for connection of new energy sources where practicable.

The task facing those responsible for building a future environment has rarely been so great, so exciting or so restricted by lack of monetary resources but equally, with modern technology, rarely has it been such a stimulating challenge.

SECTION 7

CURRENT RESEARCH PROGRAMMES

Page

Current Research in Air Pollution in Great Britain 104

Progress in Research on Air Pollution in the United Kingdom .. 111

Warren Spring Laboratory 124

Leeds University 125

The Medical Research Council's Air Pollution Unit 126

Atomic Energy Research Establishment 128

Central Electricity Generating Board 131

Current Research in Air Pollution in Great Britain

The following is a brief summary of research projects in progress in Great Britain. Full information on these projects is given in the D.O.E. Register of Research 1975, Part IV, Environmental Pollution (available from: Research Section, Headquarters Library, D.O.E., 2 Marsham Street, London SW1P 3EB). The numbers in brackets refer to those in the Register.

		Institution	*Specific Investigation*	*Estimated completion date (where known)*
1	(2)	Aston University in Birmingham	Urban air pollution due to traffic	—
2	(3)	Meteorological Office	Fog Studies	—
3	(4)	Atomic Energy Research Establishment; Environmental and Medical Sciences Division	Life cycle of sulphur compounds in the atmosphere	—
4	(5)	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	Oxides of Nitrogen	—
5	(6)	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	Photochemical Smog	—
6	(9)	Bradford University, School of Environmental Science, Halton D.C.	Appraisal of air pollution in Halton (Cheshire) district	1978
7	(10)	Brighton Polytechnic, Department of Applied Physics	Atmospheric diffusion of smoke plume from chimney stack	1976
8	(11)	Bristol City Council, Avon County Council	Atmospheric pollution in an area where intensive chemical industry is present, with specific reference to lead and zinc smelting	—
9	(14)	Bristol University, Department of Botany	Regional monitoring survey of airborne heavy metals. Effects of heavy metals on vegetation. Effects of cadmium on plants	—
10	(15)	British Antarctic Survey, Glaciology Section, Scott Polar Research Institute	Global baseline levels of airborne substances in relation to the historical record of Antarctic ice cores	—
11	(16)	British Glass Industry Research Association	Sampling and analysis of waste gases and particulate emissions from glass furnaces	—
12	(17)	Clyde River Purification Board	Contamination of rainwater by airborne pollutants	1977
13	(18)	Construction Industrial Research and Information Association	National Survey of atmospheric corrosion	—
14	(19)	Essex University, Department of Chemistry	Filtration of aerosols. Atmospheric aerosols	1976/77
15	(20)	ESSO Petroleum Co.	The movement and fate of sulphur oxides emissions in the medium and long range	1976
16	(22)	Pitlochry Freshwater Fisheries Laboratory	Nutrients in rain water	1976
17	(23)	Pitlochry Freshwater Fisheries Laboratory	Organochlorine residues in rain	—
18	(25)	Heriot-Watt University, Department of Chemistry	The formation of oxides of nitrogen in methane/air flames	1976

		Institution	*Specific Investigation*	*Estimated completion date (where known)*
19	(26)	Lancaster University, Department of Environmental Sciences	Air pollution on the Heysham Peninsula	—
20	(27)	Leeds University, Department of Mechanical Engineering	Pollutant formation within a gas turbine type combustor	1977
21	(30)	London University, Department of Mechanical Engineering/Design Laboratory	A study of simultaneous reduction of air pollution and fuel consumption for small road vehicles	—
22	(32)	Luton College of Technology, Luton Public Health Inspectorate	Environmental Pollution by vehicle exhaust emissions	—
23	(34)	Manchester University, Department of Chemistry	Environmental pollution by toxic metals, especially lead and cadmium	1977
24	(35)	Manchester University, Department of Geography	Levels of SO^2 along lines of traverse across Manchester	—
25	(36)	Meteorological Office	Sulphur budget over the British Isles and North Sea and long range transport of sulphur throughout Europe	—
26	(38)	Ministry of Agriculture, Fisheries and Food, Soil Science Department	Monitoring of trace elements in rain	—
27	(39)	Motor Industry Research Association	Atmospheric pollution from petrol engines	—
28	(40)	Motor Industry Research Association	Petrol engine pollution—long term	—
29	(42)	Nottingham University, Department of Mechanical Building. Rolls-Royce (1971) Ltd.	Computation of pollutant formation in gas turbine combustion chambers	1977
30	(43)	Nottingham University, Department of Chemistry. Rolls-Royce (1971) Ltd.	The formation of nitrogen oxide (NOx) in the presence of combustion products at high temperature	1976
31	(44)	Nottingham University, Department of Mechanical Engineering. Rolls-Royce (1971) Ltd.	The formation of pollutants in gas turbine combustion chambers	1976
32	(46)	Sheffield University, Department of Geography, Air Pollution Research Unit	Factors affecting the distribution and severity of air pollution	—
33	(47)	Southampton University	Performance and emissions characteristics of turbocharged spark ignition internal combustion engines	1978
34	(49)	Transport and Road Research Laboratory	Air pollution from motor traffic	—
35	(50)	Warren Spring Laboratory	Air Pollution monitoring	—
36	(52)	Warren Spring Laboratory	Characterisation of suspended particulates	—
37	(53)	Warren Spring Laboratory	Extension of UK national air pollution surveillance by central and local governments (heavy metals)	—
38	(54)	Warren Spring Laboratory	Fluoride emission monitoring	—
39	(55)	Warren Spring Laboratory	Measurement of smoke and SO_2 in remote areas	—
40	(56)	Warren Spring Laboratory	Monitoring of industrial emissions of grit and dust	—
41	(57)	Warren Spring Laboratory	Monitoring vehicle pollution	1977

		Institution	*Specific Investigation*	*Estimated completion date (where known)*
42	(58)	Warren Spring Laboratory	National Survey of smoke and SO_2	—
43	(59)	Warren Spring Laboratory. London University, Imperial College of Science and Technology	Noxious emissions from refuse incinerators	—
44	(60)	Warren Spring Laboratory	Study of air pollution in London	—
45	(61)	Warren Spring Laboratory	Study of airborne and deposited lead around lead works	—
46	(62)	Warren Spring Laboratory	Study of downwash from domestic chimneys	—
47	(63)	Warren Spring Laboratory	Study of long-range transport, dispersion, transformation of SO_2 in the atmosphere, both airborne and ground level measurements	
48	(64)	Warren Spring Laboratory	Study of SO_2 and smoke distribution in the UK for assessment of economic implications of control	—
49	(65)	Warren Spring Laboratory	Survey of airborne metal levels in the vicinity of metallurgical industry in the Midlands	—
50	(66)	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	Asbestos: study of its structure, respirability and behaviour in biological systems using tracer methods	—
51	(67)	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	Inhalation studies: factors affecting the deposition and clearance of particulate material in the human respiratory tract using tracer techniques	—
52	(68)	Bradford University, Postgraduate School of Studies in Pharmacology	Toxicology of welding fume particles in experimental animals and man	—
53	(70)	Leeds University, Department of Fuel and Combustion Science	Atmospheric pollution	1977
54	(71)	London University, Cardiothoracic Institute: Department of clinical Immunology	Respiratory allergic disease due to common environmental allergies, to chemical dusts, vapours and fumes	—
55	(73)	London University, St. Thomas's Hospital Medical School: Department of Community Medicine	The influence of environmental factors on respiratory disease in children	1978
56	(74)	Medical Research Council, Air Pollution Unit	Effects of emissions from motor vehicles	—
57	(75)	Medical Research Council, Air Pollution Unit	Effects of pollutants on pulmonary function by inhalation experiments at low concentrations	—
58	(76)	Medical Research Council, Air Pollution Unit	Histopathology of the lung in relation to pollution exposures	—
59	(77)	Medical Research Council, Air Pollution Unit	Development of instrumentation for lung function survey work	—
60	(78)	Medical Research Council, Air Pollution Unit	Long term trends in lung cancer and bronchitis mortality	—
61	(79)	Medical Research Council, Air Pollution Unit	Mortality and Morbidity studies in London and other conurbations	—

		Institution	Specific Investigation	Estimated completion date (where known)
62	(80)	Medical Research Council, Air Pollution Unit	Surveys of respiratory symptoms and ventilatory capacity related to pollution exposure	—
63	(81)	Queen's University Belfast, Department of Therapeutics and Pharmacology	The long-term effects of occupational exposure to asbestos	—
64	(82)	Strathclyde University, Department of Physiology and Pharmacology	Human tussigenic threshold modification on exposure to low concentrations of broncho-irritant atmospheric pollutants	—
65	(83)	University College, Cardiff, Department of Mineral Exploitation	Physical and chemical characteristics of airborne mineral particles contained in diseased tissues	—
66	(84)	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	Determination of the atmospheric concentrations and origins of trace elements and their rates of deposition to vegetation and soil	—
67	(86)	Essex University, Department of Chemistry	The effect of chlorohydrocarbons and heavy metals in the environment	—
68	(87)	Forestry Commission, Northern Research Station	Growth of trees in the Pennines in relation to air pollution	—
69	(88)	Forestry Commission, Northern Research Station	Tree growth around aluminium smelters at Invergordon and Fort William	—
70	(89)	Grassland Research Institute, Department of Soils Plant Nutrition	Growth of plants in atmospheres with controlled concentrations of gaseous sulphur compounds	—
71	(90)	Leicester University, School of Biological Sciences	Quantity and distribution of urban and rural lead pollution from motor vehicles, and its ecological implications	—
72	(92)	Liverpool Polytechnic, Department of Biology	Morphological and physiological effects of gaseous pollutants on plants	1977
73	(94)	London University, Imperial College of Science and Technology. Department of Botany	Effects of SO_2 on Lolium 1976 perenne (rye grass)	1976
74	(96)	London University, Kings College, Department of Geography	Air pollution assessment: (a) by use of distribution patterns and performance of lichens and bryophytes (b) in relation to regional topographic patterns	—
75	(97)	London University, University College, Department of Mechanical Engineering	Pollutants from petrol engines	—
76	(98)	Meteorological Office, Oxford University. Cambridge University. Bristol University. National Physical Laboratory	Studies of the effects of supersonic transport flying on the characteristics of the stratosphere and on the climate	—
77	(99)	Microbiological Research Establishment	Studies of bactericidal properties of pollutants in urban areas with reference to recognition of the presence of olefinozone reaction products	—
78	(100)	Nottingham University Department of Botany	Effects of atmospheric pollution (in the first instance particulate material) on trees	1976
79	(101)	Nottingham University, Department of Physiology and Environmental Studies	SO_2 and gas exchange of crop plants	1976

	Institution	*Specific Investigation*	*Estimated completion date (where known)*
80 (103)	Plymouth Polytechnic, Department of Environmental Sciences	Physiological and biochemical effects of combined aerial pollutants upon commercial plant species	1980
81 (104)	Sheffield Polytechnic, Department of Chemistry and Biology	The effects of air pollution on the ultrastructure of lichens	—
82 (105)	Trent Polytechnic	Air Pollution effects on plants. Recolonisation of spoil tips	—
83 (106)	University of Wales Institute of Science and Technology, Department of Applied Biology	Air pollution effects on plants and soil at Port Talbot	—
84 (107)	University of Wales Institute of Science and Technology, Department of Applied Biology	Air Pollution and plants (particles and SO_2)	—
85 (108)	University of Wales, Institute of Science and Technology, Department of Applied Biology	The effect of atmospheric pollutants upon plant growth under experimental conditions (a feasibility study)	—
86 (109)	University College, Cardiff Department of Zoology	An investigation of selective agencies, especially air pollution, affecting industrial melanism	1977
87 (111)	Glasgow University, Department of Geography. Renfrew County Council, Department of Planning and Engineering	Air Pollution in the Glasgow region	—
88 (112)	London University, Imperial College of Science and Technology, Department of Aeronautics	Numerical prediction of plume dispersal	1978
89 (113)	Newcastle upon Tyne University, Department of Plant Biology	Prediction and computer mapping of the fluoride content of pastures and meadows	1976
90 (114)	Warren Spring Laboratory	Development of mathematical modelling techniques for air pollution distribution	—
91 (115)	Warren Spring Laboratory	Predictive model of air pollution in upper Forth estuary for planning purposes	—
92 (116)	Associated Octel Co. Ltd.	Lean mixture operation	—
93 (117)	Associated Octel Co. Ltd.	Reduction and characterisation of vehicle particulate emissions	—
94 (118)	Birmingham University, Department of Chemical Engineering	Air and gas purification by adsorbents. Experimental and theoretical study of adsorption and regeneration	1978
95 (120)	BNF Metals Technology Centre	Emission control in non-ferrous metals industries	—
96 (121)	British Glass Industry Research Association	Improvement of methods of founding glass and reduction of air pollution	—
97 (122)	British Hydromechanics Research Association. Fluid Engineering	Vortex chimney	—
98 (123)	Brunel University, Department of Industrial Chemistry	Metal particulates in the atmosphere. Economics of the environment and its pollution. Catalysis and pollution control	—
99 (124)	Cambridge University, Department of Chemical Engineering	Combustion of coal in fluidised beds	1984
100 (125)	CJB Developments Ltd	Gas recovery and purification	—

	Institution	Specific Investigation	Estimated completion date (where known)
101 (127)	ESSO Petroleum Co	Chemically active fluidised bed process for sulphur removal during gasification of heavy fuel oil	1977
102 (128)	Laboratory of the Government Chemist	Determination of fume and dust emissions	—
103 (129)	Leeds University, Department of Mechanical Engineering	Investigation of the influence of electrical fields upon flame gases	—
104 (130)	Liverpool University, Department of Mechanical Engineering	Effects of water injection on engine emissions	—
105 (132)	Manchester University, Pollution Research Unit	Combustion system for reduction of vehicle emissions	1977
106 (135)	National Engineering Laboratory, Shell Research Ltd	The development of device (VAPIPE) that uses exhaust gas heat transferred by means of a two-phase thermosiphon to vapourise the air/liquid fuel mixture entering the inlet manifold	1976
107 (137)	Rolls-Royce Motors Ltd. Car Division	Closed loop fuel metering system for emission controlled spark ignition IC engine	1977
108 (139)	Salford University, Department of Chemical Engineering	Use of absorbents of high temperatures for reduction of SO_2 and NO_2 emissions	—
109 (140)	Torry Research Station	Reduction of air, water and noise pollution from fish handling and processing plant	—
110 (141)	Warren Spring Laboratory	Absorption and liquid/gas phase oxidation of odours	—
111 (142)	Warren Spring Laboratory	Aerodynamic pollution distribution problems relating to chimneys and buildings	—
112 (143)	Warren Spring Laboratory	Air pollution problems relating to process emissions	—
113 (144)	Warren Spring Laboratory	Authorisation of smokeless fuels and appliances	—
114 (145)	Warren Spring Laboratory	Catalytic oxidation for odour control	—
115 (146)	Warren Spring Laboratory	Direct thermal destruction of odours	—
116 (147)	Warren Spring Laboratory	Identification of grit and dust deposits	—
117 (148)	Warren Spring Laboratory	Motor vehicle air pollution abatement using catalytic methods	—
118 (149)	Warren Spring Laboratory	Recovery and treatment of metallurgical fumes	—
119 (150)	Warren Spring Laboratory	Solid adsorbents for odour control	—
120 (152)	Warren Spring Laboratory	System study of odour producing processes and of odour control in rendering processes	—
121 (154)	Atomic Energy Research Establishment, Environmental and Medical Sciences Division	Electron microscopy of aerosol particles	—
122 (156)	Bradford University, School of Environmental Science	Odour identification and air quality assessment using a panel of blind people	1978
123 (157)	Bradford University, School of Environment Science, Department of Planning and Transportation	The use of a mobile laboratory for pollution measurement and appraisal	—
124 (158)	British Carbonisation Research Association	Methods of analysis of atmospheric pollutants from coking plants	—

	Institution	Specific Investigation	Estimated completion date (where known)
125 (159)	British Carbonisation Research Association	Mitigation of atmospheric pollution at coking plants	—
126 (160)	British Coke Research Association	Liquid effluents and atmospheric pollution	—
127 (164)	Medical Research Council, Air Pollution Unit	Analysis of respiratory waveforms using a recently developed method for measuring changes in breathing patterns	—
128 (165)	Medical Research Council, Air Pollution Unit	Development of analytical techniques for determination of physical and chemical characteristics of pollutants	—
129 (166)	Motor Industry Research Association	Atmospheric pollution from diesel engines	—
130 (167)	Paint Research Association	Analytical methods for monitoring gaseous effluent from industrial stoving finishing plants	1976
131 (168)	Safety in Mines Research Establishment	Development of instruments and sampling techniques for measurement of respirable dust	—
132 (169)	Safety in Mines Research Establishment	Development of instruments and sampling techniques for pollutant gases (e.g. methane, monoxide and oxides of nitrogen) in mines and other working environments	—
133 (170)	SIRA Institute Ltd.	Evaluation and calibration of instrumentation for measurement of pollutant gases	—
134 (171)	SIRA Institute Ltd.	Further developments of facilities for the generation of standardised samples of suspended and dissolved liquid and gaseous pollutant substances	—
135 (172)	SIRA Institute Ltd.	Impregnated paper tapes for analysers monitoring trace gas concentrations	1977
136 (173)	SIRA Institute Ltd.	Performance assessment of instrumentation for measuring concentration of dissolved gases and pollutants	—
137 (174)	South Bank Polytechnic, Department of Chemistry and Polymer Technology	X-ray energy dispersion analysis of air particulates	—
138 (175)	Southampton University, Department of Chemistry	Electrochemical devices for the analysis of atmospheres	1977
139 (176)	Southampton University, Department of Chemistry	Species present in gases	—
140 (179)	Warren Spring Laboratory	Instrumental methods for odour analysis	—
141 (180)	Warren Spring Laboratory	Mobile facility for odour assessment by organoleptic techniques	—
142 (181)	Warren Spring Laboratory	Problems of measurement, assessment and abatement of vehicle emissions	—
143 (182)	Warren Spring Laboratory	Study of deposit gauge performances and deposition	—
144 (183)	Warren Spring Laboratory	Study of methods of measuring air pollutants for the designation of international standard methods (150, etc.)	—
145 (184)	Warren Spring Laboratory	UK deposit gauge survey	

PROGRESS IN RESEARCH ON AIR POLLUTION IN THE UNITED KINGDOM

Report by the Interdepartmental Committee on Air Pollution Research

I: GAPS AND PRIORITIES IN RESEARCH ON AIR POLLUTION

DEVELOPMENTS SINCE JUNE 1973

1. The present report outlines developments and changes in the amount of research effort devoted to the various aspects of air pollution which have occurred in the last two years. It indicates the extent to which gaps and priorities in research identified in earlier reviews are being dealt with and points to any changes in emphasis which have occurred in past months.

2. Membership of the European Economic Community has involved the UK in new international research projects (eg in the fields of harmonisation of methods, and information exchange), and in evaluations of the implications to the UK of adopting internationally agreed environmental policies and standards, as these are developed. It has also given the UK access to a large body of research work undertaken by member countries in conjunction with the CEC.

Effects

3. In its previous review ICAPR noted an increase in research on effects but stressed that there was still a need for further expansion of this work, particularly on effects of relatively low concentrations, and effects on micro-organisms.

A. Health

4. As indicated in Part 2 of the present report the research effort deployed has increased slightly, particularly in relation to epidemiological work, as projects still in the planning stage at the last review are put into operation and others are extended. Use of improved data handling systems should speed up and widen the scope of data analysis in some of the studies. New sensing techniques have improved the ability to undertake short-term experiments on effects of low concentrations.

B. Animals

5. The small amount of work in this field is largely concerned with possible effects of metals and fluorides in particular situations on farm animals, and of lead on roadside wildlife.

C. Vegetation

6. Research effort appears to have increased significantly, with further research and studies on the same subjects as before, namely uptake and effects of SO_2, metals, fluorides and NO_x. It includes projects on the effect of pollutants on crops, beneficial effects as well as cryptic damage and reduction in crop yield, and further work on forest trees. Effects of ozone and photoxidants are amongst the topics which will receive special attention. Work is planned on soil micro-organisms which, if authorised, should fill previously identified gaps in research. The latter project is being developed at the Institute of Terrestrial Ecology, whose reorganisation has taken into account NERC's recommendations for increased effort in air pollution research and pathway studies (also endorsed and recommended by ICAPR). The ITE maintains great interest in developing biological indicators of pollution. There is a need for distinguishing between effects of background and intermittent high peak concentrations, and for more positive descrimination between effects of different pollutants.

D. Effects on water

7. There is some new work aimed at studying the effect of air pollution uptake by fresh water on fauna. Various groups are investigating the contribution of air pollution to water chemistry, of particular relevance in view of current concern about wet deposition of pollutants in Scandinavia.

E. Materials

8. Effort on effects of air pollution on materials, and their abatement, has been maintained. Much of the work forms part of wider investigations on weathering and total effort is therefore difficult to assess.

9. Since corrosion of materials is one of the very few air pollution effects which has a potentially quantifiable relation with economic costs to the community, it merits more attention. The possible value to be obtained from comparison of corrosion mapping results with pollution monitoring surveys and other effects surveys has yet to be explored.

F. Climate

10. Studies have continued on the possible effects of air pollution on the composition of the atmosphere and on solar radiation at ground level. The nature and occurrence of haze merits increasing attention in view of the importance of distinguishing between industrial and urban haze.

G. Socio-economic and other effects

11. No project has been reported which is aimed at costing the effect of pollution, or otherwise quantifying its social effects. Work is now in progress which should throw light on the population exposure to certain levels of common pollutants and on the reduction in sulphur emissions needed to reduce ground level concentrations of SO_2 to various datum levels, and enable costing of pollution control measures which may be required in the future, eg as a result of the Control of Pollution Act or of EEC recommendations.

Measurement

12. The effort on methods has been maintained. There has been considerable emphasis on harmonisation and standardisation of methods, both at the national and international levels. Additional work has begun on identification and measurement of air-borne and deposited particulate matter, a subject identified by DOE as requiring further effort.

13. More attention should be paid to methods and equipment for short period measurement and for distinguishing between various pollutants, in connection with work on effects of pollution (see para 6).

Surveillance

14. Arrangements, mentioned in the last review, for extending surveillance of air pollution to pollutants other than smoke and SO_2, eg metals, and sulphur in particulates, at a limited number of sites, are now being made. Other surveys, the National Survey of smoke and SO_2, the 5-towns survey of traffic pollutants, the survey of metals in rural areas, have continued at the same level as before. Details of other monitoring of pollutants throughout the UK are being assembled with a view to possible collation and publication of comparable data. It is too early to assess the possible impact of recent legislation on monitoring activity by local authorities.

15. Methods of analysing and utilising survey data are being improved. The Committee in its previous report was concerned lest analysis of data, and investigation of effects, lag behind the collection of data.

Dispersion, modelling

16. The increased effort on large scale dispersion has been maintained, as have increases in request for wind tunnel tests, and for modelling and prediction of pollution. The effort on the chemistry, fate and interaction of pollutants has also been maintained. The increases were recommended by ICAPR in previous reports. Increased effort has been devoted to mass transport and transfrontier studies.

Abatement

17. The amount of effort on abatement, particularly on abatement of offensive odours and of vehicle emissions, has increased, as has that on monitoring of emissions with a view to improvement of the evaluation of needs for abatement as well as to improved control of emissions.

18. Much of the work on abatement of emissions from specific industrial processes is in the area of process or engineering development. In its last report the Committee gave as its opinion that the UK was lagging behind some other countries in this area.

19. The Committee notes the continuing development of alternatives to asbestos and believes this work should be encouraged. It also notes and approves the work on fluidised bed combustion and the possibilities it offers of reduction of sulphur oxide emissions from coal-fired boilers.

20. As in past years, appraisal of abatement measures and of adequacy of research on abatement is hampered by the lack of knowledge on effects of pollution.

Dissemination of results

21. In its previous review, the Committee saw a need for improving dissemination of results of UK work on air pollution. Attempts which go some way towards filling this need are: organisation of symposia, such as those held by WSL in 1974 on dispersion of air pollution, and by the AERE on Teesside mists and on medical research. The Committee also welcomes the reports by the DOE Central Unit on Environmental Pollution on monitoring of the environment and on the significance to man of lead in the environment.

Summary of conclusions

22. Whilst recognising the difficulties involved in interpreting data on effects on vegetation, and in distinguishing between the effects of various gaseous and particulate pollutants, including synergistic effects, particularly in relation to health, the Committee welcomes the scientific effort now devoted to assessing the effects of air pollution.

23. It is pleased to note the various proposals to improve the analysis of survey data, and to co-ordinate and harmonise monitoring activities.

24. It still sees a need for more effort on dissemination of results both within and outside the UK.

25. Finally, the Committee believes that the current balance of effort devoted to air pollution research in the UK is appropriate, and the amount of effort no more than adequate.

II: PROGRESS IN RESEARCH ON AIR POLLUTION IN THE UNITED KINGDOM

26. This report is mainly concerned with research partly or wholly government-funded, ie, it does not give a comprehensive report on research by industrial firms. It covers work known to be in progress or completed by September 1974.

27. It is arranged by subject, main subdivisions being:
Part 1: Effects on Health
Animal Life, Vegetation, Water
Materials
Part 2: Measurement Methods
Part 3: Dispersion and Distribution of Pollutants
Part 4: Abatement of Emissions of Pollutants.

28. The reports were collated by:
Part 1: Health—Professor P. J. Lawther (Medical Research Council Air Pollution Unit)
Animal Life, Vegetation, and Water—Dr. J. V. Lake (Agricultural Research Council)
Materials—Dr. W. H. Gutt (Building Research Establishment)
Part 2: Mr. C. M. Killick (Warren Spring Laboratory)
Part 3: Mrs. M-L. P. M. Weatherley (Warren Spring Laboratory)
Part 4: Mr. M. F. Tunnicliffe (Alkali and Clean Air Inspectorate)
in most cases from material provided by the various research workers.

29. Lists of relevant EEC-funded projects have been added to various sections for the information of ICAPR and CAC members only, not for wider publication.

30. It has not been possible to obtain realistic figures for government expenditure on research on air pollution in 1973-4, but expenditure by government departments and Research Councils was certainly in excess of £1·5 million.

Part 1: Effects of Air Pollution

A. EFFECTS ON HEALTH

ACUTE EFFECTS—MORTALITY AND MORBIDITY STUDIES

31. Studies of day-to-day variations in deaths (Medical Research Council, Air Pollution Unit) have now been extended to cover other conurbations of Great Britain as well as London, and data have also been obtained for the remaining urban and rural areas of the country. The study is being extended in depth also, looking at sub-divisions of deaths by age and by cause, and it is hoped to investigate inter-relations between environmental effects and those attributable to influenza epidemics. This large data-handling exercise has been made possible by the Office of Population Census and Surveys supplying the mortality data on magnetic tape, allowing the whole process to be completed on the computer, with microfilm output for results required in graphical form. It is hoped to obtain further pollution and weather data on magnetic tape, to integrate with this system.

32. Day-to-day variations in hospital admissions (Emergency Bed Service data) are now being followed only on a simple manual basis: there is no longer any evidence of effects of pollution, but this is one index that can be kept up-to-date to watch for effects of hitherto unsuspected environmental factors.

33. The fourth in a 5-yearly series of "diary" studies is now in progress (MRC APU) in which several hundred bronchitic patients in London are keeping daily records of changes in their condition. It will be possible on this occasion to link the results with the wider range of pollution measurements now available.

Chronic respiratory diseases in relation to pollution and smoking

34. The 1946 birth-cohort has now been followed through adolescence into early adult life (London School of Hygiene) and results at age 25 show little effect of recent air pollution exposures on the prevalence of respiratory symptoms (in contrast with the strong effect on chest diseases seen in childhood). Further studies on the role of air pollution in the prevalence of respiratory disease in children are in progress in a number of East- and West-European countries, in collaboration with the World Health Organisation.

Long-term trends in lung cancer and bronchitis mortality

35. This cohort analysis of published mortality figures (MRC APU) has been extended to bronchitis and to other groups of diseases as well as lung cancer. The main feature in relation to pollution is the gradual closing of the gap between London and rural rates: this is most evident for bronchitis, with death rates for recent cohorts of Londoners differing little from those for rural areas. Because of the migration of population and of changes in smoking habits as well as in pollution, the interpretation of these trends is, however, difficult.

Respiratory disease and lung function in children

36. In addition to a follow-up of school-children in Kent, enquiries into respiratory disease and symptoms, together with measurements of peak flow, have been incorporated into the National Study of Health and Growth. This is being designed as a longitudinal study in 28 areas of England and Scotland and measurements of smoke and sulphur dioxide are to be made in each of them in collaboration with WSL. A cross-sectional study on respiratory disease and pollution is being done among children in the 6-10 years age range as part of a collaborative project with the other member countries of the European Community.

Surveys of respiratory symptoms and ventilatory capacity

37. The final analyses of data collected in the "Fog Cohort Study" (MRC APU) has shown no dominant effect of exposure in infancy to the 1952 fog on respiratory symptoms or ventilatory capacity at the age of 18, though the effects of smoking and childhood chest illnesses were clearly demonstrable. In view of an earlier finding (Douglas and Waller 1966) that the incidence of chest disease in children was closely linked with exposure to pollution, these later findings may demonstrate an indirect effect of pollution in producing chronic respiratory disease. In the next phase of the study it is hoped to widen the scope of the ventilatory capacity measurements and to include a rural group for comparison.

38. Simple peak flow measurements have been made on further large groups of subjects in the City of London; residential history is included, as a rough indicator of pollution exposure, and there is just a suggestion from results to date of slightly lower readings from London-born subjects than from others.

Development of chronic bronchitis in relation to smoking and air pollution

39. The longitudinal study of lung function (Royal Postgraduate Medical School) has provided some valuable results on the rate of loss of function in relation to smoking, and the possible relevance of declining smoke concentrations in London is being considered.

Day-to-day variation in respiratory function

40. Analyses of the long series of measurements of ventilatory capacity (MRC APU) have been completed: effects of pollution were detectable, but in general the "random noise" introduced by infections and other uncontrolled factors made it very difficult to establish any firm quantitative relationships with pollution. Although the regular daily measurements have ceased, short series are still being done around periods of high pollution.

41. Interpretation of findings from the long series of airways resistance measurements is equally difficult. The general relationship between airways resistance and the concentration of SO_2 seen in one subject at the beginning of the series was not maintained and it is clear that factors other than pollution have a major effect on day-to-day changes.

Effects of emissions from motor vehicles

42. Work is continuing (MRC APU) on the physical and chemical properties of suspended lead particulates, in relation to their retention in the lung and subsequent absorption of lead compounds, and as background to projected studies on blood lead levels among populations particularly exposed to lead from traffic, within-subject variations in blood lead are being examined.

43. Experimental work on lead uptake is in progress at the Atomic Energy Research Establishment in which volunteer subjects are inhaling exhaust products from an engine running on petrol tagged with lead-203.

44. The work on lead pollution around Gravelly Hill has been reviewed in a report of the Joint Working Party (Department of the Environment), there is at present no evidence that the lead pollution constitutes a hazard to health. Monitoring of blood lead levels is continuing.

Effects of asbestos

45. Long-term studies are continuing on the health hazards of absestos among populations with occupational exposures, both within the United Kingdom and abroad (MRC Pneumoconiosis Unit), and the work on absestos-related diseases among ship-builders is now in progress (Barrow-in-Furness Hospital).

Effects of pollutants on pulmonary function

46. Experimental inhalation studies are continuing (MRC APU) on concentrations of sulphur dioxide in the range 1-3 ppm (3,000-9,000 $\mu g/m^3$) alone and in combination with other pollutants. The body plethysmograph used for measuring airways resistance has now been connected on-line to the laboratory computer, one object being to enable the transient changes seen in earlier experiments to be followed more closely. The use of other recently developed techniques for studying lung function, including measurements of "closing volume" are also being explored in relation to short-term effects of pollutants.

Histopathology of the lung

47. Post-mortem material is being obtained from certain groups of people characterized by their smoking habits and their exposure to urban or industrial air pollutants (MRC APU). The differential degree of mucous gland hypertrophy down the bronchial tree is being examined, together with the histology of the mucus secreting tissue, and the structure of the lung. It is hoped that these studies will provide information on the role of pollution, together with other factors, in the development of bronchitis.

Analysis of respiratory waveforms

48. A non-intrusive method of measuring changes in breathing patterns has now been developed (MRC APU), and some experiments on the effects of inhaling various concentrations of sulphur dioxide down to 5,000 $\mu g/m^3$ have been done. The signal is taken from a mercury in rubber strain gauge, and recorded on an analogue tape recorder for subsequent evaluation on the laboratory digital computer. Marked changes in breathing patterns have been seen in certain "sensitive" people with concentrations of 5ppm SO_2, and there is a need to extend the experiments to a wider range of subjects and to explore the effects of deep inspiration rather than quiet breathing of the pollutant mixtures.

Instrumentation for lung function survey work

49. Hitherto most surveys of lung function among general populations with contrasting pollution exposures have been limited to simple measurements of peak flow or forced expiratory volumes in one second, whereas a wider range of measurements, some of which appear to provide better indicators of early changes in the small airways, can be undertaken in the laboratory. A portable spirometer has now been fitted with a cassette tape recording system (MRC APU) to allow the full information on expiratory flows to be collected in the field, for subsequent evaluation on the laboratory digital computer.

B. EFFECTS ON ANIMAL LIFE, VEGETATION AND WATER

ANIMAL LIFE

Fluorosis in animals

50. Reports of fluorosis in cattle have been fewer, especially in relation to pollution from ceramic works; awareness of the problem, appropriate husbandry measures and/or compensation agreements covering changes in types of farming have continued to diminish the incidence of disease. Monitoring programmes by the three aluminium smelting companies, the results of which are seen by the Ministry of Agriculture, Fisheries and Food's Central Veterinary Laboratory, do not so far indicate a hazard to grazing stock from this source. There is no research in progress on fluorosis, only monitoring.

51. Research at the University of Newcastle includes a study of the effect of fluoride on land, freshwater and marine animals.

Effects of airborne lead on animal health

52. Several studies of the environmental pathways of lead are being pursued at the Monkswood Experimental Station, Institute of Terrestrial Ecology; the most relevant have involved analyses of lead burdens in the bodies of roadside mammals. These burdens were 1·7 to 2 times greater than those of animals living in sites away from the roads and the possibility of sub-lethal effects is being examined.

Industrial melanism

53. The survey of this phenomenon in the Manchester region, by the University Zoology Department, is continuing and an investigation of selective agencies, especially air pollution, affecting industrial melanism has begun at the University College of Wales, Cardiff; both projects have the support of the Natural Environment Research Council, and the Welsh Office also contributes to the second project.

Adverse effects of heavy metals on the metabolism of essential trace elements in animals

54. The investigations at the Rowett Research Institute on the long term effects of exposure to small concentrations of cadmium continue, as do comparative assessments of the potency of cadmium and zinc.

Effects of sulphate and acidic deposits upon fresh water fauna

55. Low pH values in the river Duddon (Lancs.) are associated with the presence of sulphuric acid from atmospheric deposition and drainage of peat bogs; this acidity adversely affects the diversity of invertebrate fauna providing food for fish. The Freshwater Biological Association is investigating in detail the contribution of atmospheric deposits to low pH values and the effects of these on invertebrates and trout. The Freshwater Fisheries Laboratory at Pitlochry has resumed its investigation of acidity in natural waters. (See also para 82.)

VEGETATION

Lichens and bryophytes

56. Surveys of lichen distribution have continued and the results of observations made by school children in various parts of Britain have been published by the University of Sheffield in the form of a map. More local surveys have included the use of lichens, by the Bangor Research Station of the Institute of Terrestrial Ecology, to assess the distribution of fluorine around Anglesey, and production of detailed lichen maps of the Liverpool and Wirral areas by the University of Liverpool.

Uptake of sulphur dioxide by soils and vegetation

57. The Central Electricity Generating Board proposes to begin a study of some biological consequences of sulphur dioxide emission. The Board is supporting a project at the University of Nottingham on field measurement of fluxes of SO_2 to artificial and natural surfaces, including crops.

58. Collaboration between Imperial College and Harwell has continued on measurements of the velocity of deposition of SO_2 and on the translocation of labelled sulphur within plants.

59. At the University of Liverpool, with support from the Government of Northern Ireland, a study of the effects of SO_2 on soil and parkland grass has shown that as a result of deposition, soil pH and rates of organic matter decomposition and nitrogen mineralisation were all low and recommendations have been formulated for applications of lime and fertiliser for use on recreational grassland in the Liverpool area. Analyses of pH, base saturation and sulphur content of soils are being used in an attempt to establish quantitative relations between the aerial SO_2 concentrations and soil conditions.

Pollution of soils and vegetation by airborne metals and salt *(see also paras 142-5)*

60. Studies at the Macaulay Institute, in association with the Agricultural Development and Advisory Service, have continued to be concerned largely with the deposition of lead emanating from vehicle exhausts. The large rate of deposition from the atmosphere on herbage during winter has been verified and this may have a bearing on the correlation between the ill health of lambs and the time spent in winter by the ewes on hill grass on some soils with high natural lead content.

61. At the Grassland Research Institute, investigations on the processes of uptake and transport of heavy metals, especially lead and cadmium, by forage plants have continued, with the aim of establishing the content of these metals in plants where there are minimal inputs from the atmosphere.

62. At the University of Bristol NERC has recently provided a grant for research on the dynamics of cadmium in a contaminated environment. The work includes studies of atmospheric input and deposition in plant communities as a development of recently completed biological monitoring of heavy metal in the Avonmouth area.

63. The Tree Biology Research Station, Institute of Terrestrial Ecology, has a programme on physiological studies of variation in tolerance to lead and other heavy metals amongst forest species, dealing mainly with metal contamination of soils. The scope of the work has recently been extended to include atmospheric contributions to the total exposure of plants to lead and other heavy metals.

64. A review on the effects of salt upon vegetation has been completed and published by the Coastal Ecology Research Station, ITE; the effects of road salt spray on vegetation were similar to those on coastal vegetation exposed to sea spray.

65. At the University of Cambridge, a student from the University of Bangkok (with World Bank support) is studying the effects of salt and lead on roadside and other habitats.

Effects of sulphur dioxide, fluorides, Nitrogen oxides, particulate matter and ozone in vegetation

66. Studies at Rothamsted Experimental Station of air pollution effects on barley growing near the Bedfordshire brick fields have continued using plastic greenhouses supplied with either filtered or unfiltered air and have shown that at average levels of pollution up to 75 μgm SO_2 and 0·59 μgm^{-3} F, the yield loss was not measurable and could not have exceeded 10%. Different sites were used in successive years with essentially the same results; for 1975 an experimental site where the daily pollution is expected to be about 120 μgm^{-3} SO_2 and with a correspondingly greater fluoride level, has been selected for experiments with open top plastic chambers, the use of which avoids the warm and humid conditions that occur in greenhouses. So far, definite inhibition of barley growth has only been observed with field grown crops fumigated artificially with 450 μgm^{-3} SO_2 for up to five days.

67. At the University of Nottingham, a project financed by ARC aims to investigate, under controlled conditions in growth chambers, the rates of photosynthesis, respiration, transpiration and growth of agriculturally important plants at SO_2 concentrations typical of their natural environment. In particular, the study will concentrate on crop plants that experience the large SO_2 concentrations (100-300 μgm^{-3}) prevalent in autumn and winter in that particular locality.

68. At the Grassland Research Institute an apparatus has been built comprising 10 transparent plant growth cabinets through which air is pumped and in each of which it is possible to control and monitor the concentration of sulphur dioxide. The aim is to determine how far supplies from the air will meet sulphur requirements when the supply to the roots from the soil is inadequate and so far it has shown that a concentration of 50 μgm^{-3} in the air (equivalent to that found in rural England) was sufficient to supply the needs of ryegrass plants grown for 84 days in sulphur deficient soil, yet caused no damage compared with SO_2 free air, to plants growing in soil with adequate sulphate. The next step is to define more closely the concentration at which atmospheric SO_2 ceases to be beneficial to plants.

69. Research on the effects of SO_2 on ryegrass at Imperial College (Silwood Park), supported by ARC, complements that at the Grassland Research Institute and one aim is to explain the difference in the results obtained previously at the two laboratories. Prolonged exposure to 150 μgm^{-3} SO_2 (ie substantially greater than that used at GRI) suppressed growth more in plants growing in GRI soil than in ones growing in the soil used in previous IC investigations. Effects on both growth and photosynthesis are being studied and factorial experiments are in progress to test interactions with different levels of sulphur and nitrogen in the soil.

70. At Sheffield University, with NERC support, studies have continued on the effects of SO_2, on two species of ryegrass and on cocksfoot growing in glasshouse compartments with forced ventilation. In summer, seedlings in sand culture with abundant nutrition, or in fertilised soil, responded favourably to filtration of the air which decreased the SO_2 from 73 to 30 μgm^{-3} in 1973 and from 94 to 15 μgm^{-3} in 1974. Plants grown in nutrient-poor soil showed a small effect in the opposite sense.

71. These studies on the effects of SO_2 on cereals and grasses are still continuing to reconcile the findings of different workers.

72. An observational study on oak leaves growing in a wood near a smokeless fuel production plant is being made

by the University of Wales, Institute of Science and Technology, Cardiff, with NERC support. A relationship has been found between the maximal stomatal resistance (ie in the dark) and the proportion of pores held open by particles jammed in them. Leaves with the greatest accumulation of particulate matter also had the largest total sulphur content and topics of study include the interacting effects of SO_2 and particles of stomatal aperture and the use of carotenoid leaf pigments as indicators of damage. NERC has also supported a pilot study of controlled environment facilities for air pollution and tree growth research.

73. The effects of sulphur dioxide on three widely distributed tree species are being studied at Imperial College (Silwood Park) with NERC support; the aims are to determine whether pollution affects growth and whether resistant strains have developed in long polluted areas, and to formulate rapid physiological tests of damage that may be used on stands of established trees. Transparent fumigation chambers have been used to compare the effects of 150 and 5 μgm^{-3} SO_2 on seedlings of Scots Pine, Sycamore and Silver Birch; measurements have included dry weight increase, leaf area, photosynthetic rate and the rate of uptake of labelled sulphate ions.

74. The role of SO_2 and NO_2 as interacting pollutants in the atmosphere of the Heysham peninsula has continued to be studied by the University of Lancaster (with NERC support). Tall trees in the area were considerably damaged despite the small concentrations of the pollutants; the possibility that this is due to synergism is still being explored.

75. In laboratory experiments at the University of Lancaster a synergistic effect on visibly damaged bean leaves has been clearly shown, although effects on photosynthesis were only additive and showed complicated trends with time. Enzyme studies have begun and a synergistic effect of the two gases on peroxidase activity in peas has been demonstrated. NERC has also recently awarded a grant for a feasibility study of biochemical indicators of air pollution damage to plants.

76. At the University of Cambridge (with Science Research Council support) a study is being made of the effect of sulphur dioxide on stocks of weed seed from different sources.

77. The Forestry Commission continued observations on trees around aluminium smelters at Invergordon and Fort William. At Invergordon there was no obvious or acute damage to conifers; broad leaved trees closest to the smelter showed signs of possible damage. At Fort William, fluoride concentrations to foliage were larger, but the observations were difficult to interpret because the trees had also been attacked by insects.

78. Studies on fluoride pollution, especially in connection with an aluminium smelter in Northumberland, have also continued at the University of Newcastle mainly with industrial support. Topics include a rapid screening technique for fluorine tolerance in higher plants and a study of the feasibility of predicting the fluoride content of the vegetation from atmospheric concentrations. Other projects include an assessment of the importance of ethylene as a pollutant.

79. Work by Imperial College (with NERC support) in collaboration with Harwell has shown the feasibility of using sensitive tobacco varieties as indicators of ozone; a significant positive correlation was obtained between the ambient ozone dose and the degree of leaf damage on tobacco plants exposed outdoors at Silwood Park.

Effects of pollution on plants in glasshouses

80. At the Glasshouse Crops Research Institute, small controlled environment plant growth chambers are being built to study the effects of air pollution on glasshouse crops, particularly in relation to the use of hydrocarbon fuels for heating and CO_2 generation. Advice and technical assistance are provided to ADAS and the horticulture industry on pollution in relation to protected crops and on CO_2 as a pollutant in mushroom houses.

81. The University of Lancaster also has a glasshouse project. The propane and kerosene burners used to provide carbon dioxide enrichment of the glasshouse atmosphere generate nitrogen oxides by heat-induced combination of atmospheric N_2 and O_2; the concentrations that have been detected were below the damaging threshold if species of NO_x were the only pollutants.

WATER

(see also para 55)

Institute of Hydrology

82. Part of the Institute of Hydrology's base-line programme includes study of the cycling elements in the Plynlimon catchment and the determination of how the river water derives its chemistry. The ratio of elements in rain and river water is similar. Air pollution is not a significant factor at Plynlimon but heavy metal and sulphate measurements are being intensified to determine the contribution of the atmosphere to water chemistry which will provide useful background data. A snow-melt programme has also been initiated.

MATERIALS

Effect of environmental factors including air pollution as a factor in the durability of building materials

Zinc as a reference material

(CEGB South Eastern Region)

83. Research has continued, using zinc as the measurement reference, on the corrosive effects of the atmosphere in different parts of the British Isles. The objective is to produce a corrosion map from zinc specimens located at every 10 kilometre square area throughout the country. In all, some 3,604 zinc reference units have been exposed at 2,602 sites for two separate continuous periods of 24 months. Results are still being assessed.

Atmospheric pollution of natural stone

(Building Research Establishment)

84. Comparative trials of methods for cleaning of external surfaces of masonry have been carried out and the rate of re-dirtying is now being observed. Research is also in progress into ways of impregnating historically important stone with resin in order to immobilise soluble salts derived from atmospheric acidic gases such as sulphur dioxide, which are the main agents of decay.

Corrosion of steel

85. The Transport and Road Research Laboratory programme aimed at defining criteria for assessment of the potential corrosivity of a prospective bridge location has continued. Results from up to three years indicate that atmospheric chlorides and sulphur compounds have a major influence on the corrosion rate. Two year results will be reported soon in LR 550. Research has also been carried out (LR 583) on the performance of a range of paint systems on actual bridges and attention has been drawn to the features of the bridge environment which are important from the point of view of corrosion protection.

It is reported that sheltered bridge steelwork is not washed by rain and is subjected to condensation and the build-up of corrosive contaminants. The effect of chloride on unpainted weathering steels is being studied.

86. British Steel Corporation Research and Development Department has continued research on performance of weathering steels under different weather conditions and in polluted atmospheres. The influence of rust residues on subsequent paint performance has been linked statistically in an exposure trial to type of rust as well as to paint type and film thickness.

Effect of air pollution on Post Office equipment

87. The Post Office has continued to assess data from the measurement of the vertical distribution of sulphur dioxide at the Birmingham Radio Tower but the measurements have now ceased. A report is being prepared. Indications are that the high levels of pollution which occur are of short duration and are so randomly spaced in time as to be unlikely to cause troublesome corrosion to external equipment or to electronic equipment within the towers.

Part 2: Measurement Methods

MEASUREMENT IN THE AMBIENT AIR

88. The trend towards automatic, instrumental methods referred to in the 1973 report has continued. Increasingly there is a move away from wet chemical methods of measurement towards physical methods such as infra-red.

89. Work on the chemiluminescent method for measuring the oxides of nitrogen is continuing at several laboratories. The National Gas Turbine Establishment is working to improve the life and efficiency of the converter (used to reduce nitrogen dioxide to nitric oxide for measurement purposes) particularly when the gas stream also includes hydrocarbons. The British Glass Industries Research Association is checking a variation of the Saltzman method (Clayton) by interlaboratory tests. The Scientific Instruments Research Association is testing various techniques for the production of standard gas mixtures of sulphur dioxide and nitrogen dioxide and has applied the results to a detailed evaluation of the performance of commercial colorimetric and chemiluminescent NO_x analysers.

90. In addition to the chemiluminescent method, ultraviolet absorption is now being used for measurement of ozone (WSL) although the method is subject to interference from eg hydrocarbons.

91. The AERE has developed peroxyacetyl nitrate (PAN) monitors using gas chromatographs equipped with electron capture detectors.

92. Little change is reported in the techniques for the measurement of sulphur dioxide. WSL has tested a permeation device proposed by West for measuring long-term mean ambient concentrations of sulphur dioxide by collection in sodium tetrachloromercurate. MRC APU is developing a fast response recorder using a conductimetric technique.

93. A new portable carbon monoxide monitor, known as the Ecolyser, utilises an electrochemical reaction to determine ambient levels of that pollutant. SIRA is assessing commercial monitors for carbon monoxide and carbon dioxide.

94. Ambient concentrations of particulates are being measured both as total mass and as individual elements. The main method of mass measurement is still by collection on a filter paper followed by measurement of the reflectance of the stain by means of a reflectometer (WSL). An alternative method of analysis being investigated by WSL and Shell Research uses the absorption of B particles by the stain compared with that of the clean filter. WSL is also studying an instrument which relies on the frequency change induced in an oscillating crystal by the mass of particles impacted on it.

95. Lead is an element of great interest. Imperial College (Public Health Engineering) has developed a new method of determining organic lead and particulate lead in urban atmospheres. Particulate lead is collected on a Millipore filter; the air then passes through an adsorption tube cooled by liquid nitrogen. Both forms of lead are determined by atomic absorption.

96. The University of Newcastle has developed a large-volume air sampling system for measuring air-borne heavy metals.

97. The CDE is exploring the possibility of measuring common gaseous pollutants by long-path infra-red spectrometry. Typical detection limits with a 40 m path are better than 1 ppm, eg nitrogen dioxide 0·01 ppm, the exception being hydrogen sulphide, 50 ppm. This laboratory is also monitoring organophosphorous compounds in the air and in rainwater using gas/liquid chromatography and a phosphorous detector, and organochlorine compounds by electron capture, using automatic injection of the sample.

98. Hull University is investigating the monitoring of air pollutants by laser techniques. This includes the fabrication of tunable diode lasers and their use in monitoring devices, testing the feasibility of using an optical radar system and the use of computer modelling to compare various alternative detection techniques.

99. Odour measurements, using a dynamic dilution technique and the human nose for detection, are being made at two laboratories (WSL and Shell Research). Two large-scale dynamic dilution rigs are in use at WSL, one of which is installed in a mobile odour laboratory. A portable version is being developed.

100. Individuals from many laboratories are taking part in national (BSI) and international (ISO) committee meetings to standardise measurement methods. Work is in progress on the following pollutants: sulphur dioxide (hydrogen peroxide, TCM thorin, instruments and sampling); hydrogen sulphide; carbon monoxide (non-dispersive infra-red technique (NDIR) and gas chromatography); oxides of nitrogen (chemiluminescence); particulates (gravimetric).

Measurement in the upper atmosphere

101. Various aspects of upper atmosphere pollution, of interest in view of the possible deleterious effects of supersonic aircraft, are being studied by NPL. A light-weight mid infra-red radiometer is to be installed in a balloon and used to measure water vapour, ozone and temperature. Balloon and aircraft-mounted Fourier emission and absorption equipment is being used to measure concentrations of nitric acid, oxides of nitrogen and water vapour. Work is in progress to extend the technique to detect atomic oxygen, OH, HO_2 and H_2O_2. A theoretical study has been made of a satellite sensing device and this study will be extended to devices for use at all altitudes.

Measurement of emissions

102. Shell Research has now standardised on chemiluminescence for the determination of total oxides of nitrogen in stack gases; the Saltzman technique is used only for cross-checking and calibration purposes. The Motor Industry Research Association is working to improve the method of measurement of oxides of nitrogen from petrol engines.

103. Shell Research is investigating the measurement of sulphur dioxide in flue gases using NDIR but is finding problems with the large amounts of water present. The same laboratory has expressed an interest in the continuous measurement of sulphur trioxide/sulphuric acid in these gases. No adequate monitor exists at present.

104. Particulate levels in exhaust gases are being measured by optical obscuration (NGTE) and in flue gases by filtration (BGIRA), and with automatic change of filter (BNFMTC). MIRA is continuing its work on the specification of smokemeters for measurement under transient conditions.

105. Hydrocarbons continue to be monitored by flame ionisation detection. NGTE is working on the optimization of the equipment for hydrocarbons likely to occur in exhaust gases.

106. BP has mounted a prototype flue gas monitoring instrument package in a van to measure SO_2, NO_x, CO, oxygen and hydrocarbons. The gases are measured at up to 80m from the stack, using a heated flexible sampling line. The system is specially useful for sampling from process plant where access for monitoring equipment is restricted or hazardous.

Measurement in factory atmospheres, etc.

107. The Laboratory of the Government Chemist continues to develop field and more precise laboratory methods for the determination of toxic substances in industrial atmospheres. A revised method for carbon disulphide has been published and the existing method for aromatic isocyanates etxended to enable their determination in the presence of aromatic primary amines. Work is in progress for the development of tests for ammonia, cadmium, formaldehyde and mercury, and for aromatic amines, including a method involving gas chromatographic determination of their heptafluorobutyryl chloride derivatives.

108. Pest Infestation Control Laboratory (MAFF) is evaluating infra-red spectrophotometric methods for monitoring the concentrations of methyl bromide and chlorohydrocarbon vapours near the threshold limit values in the vicinity of fumigation operations in warehouses, factories, etc.

109. The BGIRA has modified standard HM Factory Inspectorate methods to ensure collection of total lead and fluoride in factory atmospheres.

110. SIRA has evaluated commercial instruments designed to detect flammable atmospheres.

Part 3: Dispersion and Distribution of Pollutants

Studies of dispersion on global scale

111. AERE conducts a world scale programme of sampling and analysis for radioactive fallout in air and rain, partly funded by the National Radiological Protection Board. The programme is designed primarily to provide a regular inventory of the radioactivity from nuclear test explosions but the radioactive debris during its passage through the atmosphere also serves as a tracer of meteorological processes. Eight stations are operated in the UK and 20 overseas. The programme has been operated continuously since 1952 and results are published annually (the latest in AERE Report 7540).

Dispersion of chimney gases

112. The study by the MO of the diurnal evolution of a convective boundary layer has continued, in the light of data from the Cardington turbulence and profile soundings and from French aircraft measurements of temperature and humidity fluctuations. The studies are of importance in the estimation of vertical dispersion of a plume.

Use of wind tunnels in dispersion studies

113. WSL's large wind tunnel has been extended; it is fitted with means for simulating the atmospheric boundary layer and instrumentation for measuring concentration, air speed and turbulence. The laboratory also has a second, smaller wind tunnel. The larger one is at present mainly employed on solution of dispersion problems under contract, the smaller one on a model study of the efficiency of dust deposit gauges. A study of the dispersion of dense gases has recently been completed under contract to UKAEA and an experimental comparison of model versus full scale measurements is in progress.

114. The CEGB (Marchwood Engineering Laboratories) has continued to use its wind tunnel, which has provision for accurate simulation of velocity profile and turbulence structure of the atmospheric boundary layer, to provide analogue models of plume behaviour. Problems examined include the concentration field downstream of a gas turbine stack and the effect of large buildings on diffusion under various wind directions, stack heights and emission velocities.

115. At Cambridge University (Dept of Applied Maths and Theoretical Physics), wind tunnels and a variable

density water flume are being used to study turbulent flows around obstacles similar in shape to buildings and hills, and the effect of these flows on local dispersion of airborne pollution.

Dispersion of gas combustion products

116. British Gas R & D Division is carrying out some work on the siting of flue terminals in domestic and commercial premises and is co-operating with the DOE Working Group responsible for the preparation of recommendations for chimney heights for gas-fired heating plant.

Dispersion of lead from vehicles

117. A theoretical paper on the travel and deposition of lead aerosols has been published by the AERE (AERE R 7676). This treats the lead emission from a moving vehicle as a line source. Theoretical calculations of the lead in air at various distances from roads with given traffic density appear to be in good agreement with published data.

Modelling of pollution

118. WSL has carried out a short study of the distribution of smoke and sulphur dioxide (presented in the form of contour maps), and of the likely impact of large industrial developments, for the West Central Scotland Plan. The air pollution survey and regional modelling of the Forth Valley, commissioned from WSL by the SDD, in progress for some 15 months, is being used to guide decisions on future industrial development.

119. DOE and WSL are jointly investigating the distribution of smoke and sulphur dioxide concentrations throughout the UK in relation to the WHO air quality guidelines. The object is to assess the extent to which the guidelines are exceeded, the contributions from the various types of source, and the economic implications of reducing concentrations. The first stage of the study, involving contour mapping of the distribution of smoke and sulphur dioxide, is almost complete.

120. WSL is also continuing with more basic studies of diffusion modelling and of the statistical properties of air pollution observations. A detailed study of the relation between meteorological parameters and daily values of smoke and sulphur dioxide concentrations in the Manchester area has been carried out at the University of Manchester under contract to WSL, and is now being extended to other parts of the UK. A similar study of the Clyde valley has been carried out at Strathclyde University on behalf of the Scottish Branch of the National Society for Clean Air; the application of a diffusion model to the Glasgow area is also under consideration.

121. The use of meteorological data in predictions of air pollution, particularly for point sources, is being studied at Imperial College (Dept of Mathematics) together with effects of small scale topographical features on plume dispersion.

Planning

122. A project of relevance in the air pollution field has been commissioned by the SDD and DOE at the University of Aberdeen, to help local and central planning authorities carry out their responsibilities for development control. The objective is to develop techniques for appraising the potential impact of industrial development on the physical environment at sites where major developments are likely to be incompatible with existing land uses.

123. A comparable two-year exercise has been funded jointly by the Welsh Office and NERC at University College, Cardiff, and the University of Wales Institute of Science and Technology to examine the ecological implication of major land-use developments in Wales, with a view to identifying current inadequacies in communications between ecologists and planners and in applied ecological research.

Long range transport

124. The programme of work carried out by the UK Project Group (including Warren Spring Laboratory, the Meteorological Office, the Atomic Energy Research Establishment, the Central Electricity Generating Board, the National Coal Board, and the Institute of Petroleum) during the first measurement phase of the OECD programme, July 1972 to December 1973, has been reported upon (DOE, CUEP). Now that it is accepted that transport of pollutants over distances in excess of 300 km does occur, UK opinion is that the emphasis should be on quantifying long range transport and deposition of acid sulphur compounds, and studying the possible effects of such deposition.

125. The UK programme within the OECD project has included ground level sampling of precipitation, SO_2 and particulates at remote country sites (WSL with the co-operation of the MO).

126. The UK programme outside the OECD project has included the sampling of SO_2 at selected country sites (WSL) together with aircraft flights off the coasts of England, Denmark and Norway to sample pollutants at several heights within the mixing layer (WSL and MO/AERE), field work on deposition of SO_2 (AERE, CEGB) and assessment of the Barringer Correlation Spectrometer to measure total flux of SO_2, over the earth's surface (CEGB). Emission assessments have been made (WSL, MO) and trajectory analyses and diffusion modelling (MO), the model incorporating most of the more important physical processes affecting dispersion, namely sources and sinks (dry deposition and wash-out), mixing depth variation between day and night, wind direction and speed; this simple trajectory model as applied to sulphur transport to Southern Norway gives contributions from the various surrounding countries (including the UK) which are in quite good agreement with an analysis of actual measurements made in Norway of dry and wet deposition (IP). The methods used by the various workers for sampling and analysis of the pollutants have been compared. The measurement of sulphate particles from aircraft, as well as SO_2, has thrown further light on the fraction lost by dry deposition of SO_2, and the general rate of conversion of SO_2 to sulphate and its major dependence on humidity.

127. Some trial collections of Freon 11 ($C\ Cl_3\ F$) have been carried out (MO) during MRF flights, in connection with long range conservative tracer studies, and have yielded vertical profiles which appear encouraging in so far as they confirm the possibility of measuring Freon emitted from the UK over and above background levels.

Distribution of pollutants throughout the United Kingdom

128. The National Survey of Smoke and Sulphur Dioxide (operated by WSL in co-operation with local authorities, CEGB etc) has continued on the same scale as before, with some relocation of sites within the new local authority boundaries. The last sections of the Regional Reports on the Survey for the years 1961 to 1971 have gone to HMSO for printing. WSL is planning to revise the system of summarised data storage in order to facilitate data retrieval and analysis, and is introducing further quality control of the measurements.

129. The DOE CUEP report on monitoring in the environment has recommended extending the National

Survey to measure other pollutants at from 3 to 20 sites, depending on the pollutant.

130. Tentative suggestions re the siting of the instruments to measure sulphur and other elements in airborne particulates have been submitted to the DOE committee set up to co-ordinate and direct air pollution monitoring. These pollutants are already being measured at a few sites for various purposes (see the sections on Multi-element studies, para 135 and on Long-range transport, paras 124-7). Three sets of equipment for measurement of NO_x, O_3 and hydrocarbons have been purchased, and the O_3 monitors operated in various types of situation for some months.

131. The Scientific Branch of the GLC has continued to measure air pollution levels in London's atmosphere in support of the Council's interests and obligations. In particular, it is participating, together with the CEGB and the WSL, in a monitoring programme to establish the pattern of pollution, and especially the frequency of short duration, high concentrations of sulphur dioxide, in the vicinity of Battersea power station with its comparatively short chimneys and measuring dust deposition at several sites around Edmonton Incinerator. It also makes miscellaneous measurements to provide the background for responses to specific requests from Council departments, eg measurements of carbon monoxide, smoke (and sometimes airborne lead) concentrations before and after the implementation of major traffic management schemes.

132. The Air Pollution Research Unit at Sheffield University has continued its work in Sheffield and is also carrying out studies of pollution in Sherwood Forest, affected by adjacent industrial expansion, and in Doncaster and surroundings, for the local authorities concerned. It has also begun a two-year study of NO_x and CO in different kinds of urban environment, on behalf of the British Gas Corporation.

133. Air pollution samplers have been installed on gas and oil platforms in the North Sea by workers at the Imperial College of Science and Technology (Department of Mathematics).

Co-ordination of air pollution measurements

134. WSL is endeavouring to find out from local authorities what air pollution surveillance they are conducting outside the National Survey and what their future desires are as regards monitoring. A first simple questionnaire has been sent to some 700 authorities and a second detailed one will go to positive respondents. It is hoped that the information in the returns will show whether the surveys are capable of yielding results which could be used to provide 'national' statistics on air pollution levels for a greater range of pollutants than at present.

Multi-element studies

135. The studies carried out by the AERE of the distribution and origin of trace elements in surface air, the deposition inventory and mechanisms of transfer to the ground (and sea) for NERC (seven rural sites), MAFF/DAFS (Fisheries Laboratories) (three sites) and the Welsh Office (eight sites, and in association with parallel agricultural and medical surveys) have been completed and written up in three reports (AERE R 7669, 7733 and 7729). In the case of the WO study MAFF's parallel analyses of milk, vegetables, soil herbage and animal offal have also been reported upon. Some general conclusions resulting from these studies have been published (in Nature). The sponsorship of the network of rural stations set up for the NERC study has been taken over by DOE via WSL, so that any long-term trends in the atmospheric levels of many metals can be observed. The MAFF/DAFS work is being continued in a slightly modified form, still with the co-operation of AERE and with some support by NERC, to enable better estimates to be made of atmospheric deposition of metal and organohalogens into the North Sea. Measurements of the concentration of some 25 elements are made in air, rain and dry deposition at five positions on the east coast, from the Shetland Isles to Suffolk, and rainwater samplers have also been installed specifically for mercury and organohalogen analyses. Another station is located at Petten (Holland) with the possible introduction of a further station near Bergen (Norway).

136. The AERE is studying the relationship between concentrations of trace elements in the atmosphere and particle size using Anderson samplers at two sites.

137. MAFF has started a new study in which soil and herbage samples are examined for a range of metals from three sites around Avonmouth and two control sites in North Somerset. The work in the East Riding of Yorkshire has been completed.

138. The MAFF survey of the trace element content of rainwater at six sites has been completed and a final report is being prepared.

139. The Chemical Defence Establishment is measuring six elements in ambient particulates, by emission spectroscopy, on a routine basis at two sites.

140. In addition to the new studies by AERE (NERC contract) of sea surface enrichment of trace elements, and its effect upon the atmospheric aerosol, this involved both field sampling and laboratory studies.

141. Air/sea surface interactions involving trace metals are being investigated as part of wider marine studies by the Institute for Marine Environmental Research and element interchange between the atmosphere and water is being studied in connection with a project on the role played by natural organic films in the chemistry of the sea surface (University of East Anglia, NERC grant). Trace metal cycling is also being studied by the Institute of Hydrology (see para 82) in connection with water quality.

142. WSL is also carrying out a multi-element study in the Birmingham area, in the vicinity of general metallurgical activities. A survey of the quantitative distribution of mercury compounds in air and rain, as well as in water, plants, animals etc, has been started at Chelsea College (NERC grant). The same college has undertaken a survey of relative burdens of atmospherically borne metals in Britain (NERC grant) using collection and analysis of mosses. A concurrent examination is being made of the relationship between integrated aerial concentrations of metals (measured directly) and metal uptake by mosses.

143. The sources (including the atmosphere) of trace elements in soils in urban areas are being studied at Edinburgh University (with a NERC grant, and EEC support), together with uptake by plants and possible effects on plant growth.

Lead

(See also Traffic pollutants, and Dispersion of lead)

144. The collaborative survey involving Birmingham's City Public Health Department (now the Environmental Department), the City Analyst and, initially ,the University of Birmingham's Chemistry Department is still under way. Dust from road surfaces, pavements, school playgrounds and from the inside and outside of houses is being

examined, mainly for lead but also in some cases for other metals. All the premises in the City which use lead in any form are being investigated. The lead levels around a particular works are such as to cause concern but evidence suggests that the lead is being transported physically either by the shoes of workers or by vehicles or both rather than by emissions from the plant itself. The scale of the work is being intensified in an effort to find a solution to the problem.

145. The AERE is measuring uptake of exhaust lead, tagged with lead-203, by leaves, in a wind tunnel. Data on lead in vegetation in relation to fallout, assembled by the AERE (R 7676), have been used to estimate the rate of deposition of lead near the Avonmouth smelter from measurements of lead in grass. The estimate made in this way, namely 12 $\mu g\ cm^{-2}\ month^{-1}$ at 1·1 km from the smelter, agrees well with the result of deposit gauge measurements (18 $\mu g\ cm^{-2}\ month^{-1}$ at 1·2 km) recently published in the DOE CUEP report on lead in the environment.

146. Air quality standards and emission control are being studied, together with the case for having standards and control, at Imperial College (Department of Mathematics), with particular reference to lead.

Hydrocarbons

147. The Public Health Engineering Section of the Department of Civil Engineering at Imperial College is engaged in studies of the dispersion of hydrocarbons in two areas: in the vicinity of Heathrow airport, and on Teesside prior to the installation of the North Sea Oil Terminal.

Pollution by traffic

(See also Dispersion, para 117)

148. A study of lead and other traffic pollutants in the vicinity of the Gravelly Hill motorway interchange before and after it came into operation is being carried out by the University of Aston (Chemistry Department) with grants from the City of Birmingham and from TRRL, which is also contributing towards traffic counting. This work is supplemented by an examination, for lead, of road dust in the vicinity of the interchange, being carried out by the Environmental Department of the City. Blood lead levels of people living close to the interchange have been estimated. The work to date suggests that the average lead levels in two small groups of men and women in the area have risen since the M6-A38(M) interchange opened but even the latest blood lead levels are well within the normal physiological range.

149. The importance of the work was thought to be such that the Government in March 1974 set up a Joint Working Party on Lead Pollution. This is examining the situation near the Gravelly Hill Interchange and the whole question of lead pollution in the City. Part of the future work will be to try to establish a blood reference level for people living in an urban community. It is proposed to examine about 1,000 school children and about 400 adults for blood lead levels.

150. By autumn 1974 pollution from vehicles was being measured in all but one of the towns involved in WSL's Five Towns Survey.

151. The Department of Civil Engineering at Imperial College is still concerned with air pollution problems in relation to road traffic and town planning.

Pollution by supersonic aircraft

152. Research by the MO and in outside organisations and universities on the effects of SST operations on the composition of the stratosphere and on the climate of the earth have continued, under the guidance of a committee under MO chairmanship. It includes a study of the basic photochemistry of the ozone layer. Relevant laboratory work on photochemical processes is also in progress at Oxford and Cambridge Universities (see Life-history of pollutants, para 162).

Pollution from other specific sources

153. A monitoring programme has been set up by the Vale of Glamorgan BC (in consultation with WSL) in connection with complaints of air pollution in South Glamorgan allegedly caused by cement works and power stations.

Distribution of pollution in rural and remote areas

(See also Multi-element studies and Long-range transport, paras 135 & 124)

154. The MO, with the help of the LGC's analytical services, has continued to measure sulphur, chlorine, sodium, potassium, calcium, magnesium and ammonia in air and in rain, and nitrate and carbonic acid in rain at three remote sites.

155. CDE continues to monitor rural atmospheres at Porton. At present, monitoring is restricted to the measurement of concentrations of organophosphorus compounds and heavy metals on seven-day air samples, organophosphorus compounds on seven-day rainwater samples and to routine automatic monitoring of background levels of volatile organochlorine compounds, especially Freon 11, Freon 12 and carbon tetrachloride.

Study of vertical distribution of air pollution at Birmingham Post Office Tower

(See para 87)

Distribution of pollution in relation to meteorological and geographical factors

(See also Modelling of pollution, para 118)

156. The Teesside CB's survey of air pollution in relation to health was curtailed as a result of local autohrity reorganisation. A preliminary report on air pollution and respiratory symptoms in Teesside children has been published and will be followed by another on effect of air pollution on respiratory cripples. A comprehensive picture of effect of weather patterns on distribution of pollution within the conurbation is being developed. Teesside is also involved in the EEC study of air pollution and health of children (see para 36).

157. The MO forecasting scheme for urban levels of SO_2, under test at London Weather Centre, against measurements at Finsbury, satisfactorily predicted the only two major peaks in the past winter half-year (during October and November). Otherwise there has been a tendency to overestimate the general level of pollution, especially during February, and this is thought likely to be due to reduction of fuel consumption not allowed for in the scheme. The scheme appears to have worked very well, a conclusion which is supported by verification statistics.

158. The oil industry is also actively engaged in this field. Studies include monitoring of sulphur dioxide and particulates by Burmah-Castrol and others in the vicinity of their refineries at Ellesmere Port (as part of the National Survey). Esso has been engaged in surveys and analyses of contribution of various classes of fuel users to ground level concentration, having regard to location and meteorological

conditions. BP has been engaged in studies of dispersal of pollutants in the vicinity of urban and industrial complexes including dispersion from a European refinery complex (for Concawe).

Air pollution in relation to climate, etc.

159. The joint AERE/MO study of radiation fog has been completed.

160. Measurements of temperature and humidity have been made at regular intervals in the lowest 1500 m of the atmosphere on stable anticyclonic days in summer, using radiosondes (Nottingham University, School of Agriculture), in a study of the atmospheric aerosol and the radiation budget at the earth's surface, which also involves simultaneous measurements of heat fluxes and solar radiation at the ground. The results show that absorption of solar energy by atmospheric aerosol is an important source of heat in the lower atmosphere on turbid days. The work is continuing to study effect of aerosol on infra-red radiation from the atmosphere.

161. MRE is studying the role of the Open Air Factor in the production of 'white haze' (ammonium sulphate aerosol). The aim of the investigation initially is to determine whether the increase in white haze can be related to the increase in the use of petroleum products.

Use of effects as pollution indicators

(See Lichens, para 56 and Zinc, para 83)

Life-history of pollutants in the atmosphere

162. The AERE continued its measurements of ozone at Harwell during 1973 and extended them to a site at Adrigole on the SW coast of Ireland. Intended as a background site the latter in fact showed a number of days with elevated levels similar to those observed at Harwell, Silwood Park (near Ascot) and even central London; the photochemical ozone in Ireland has been shown to have originated from sources of the precursors (hydrocarbons and nitrogen oxides) up to 1,000 km distant. Measurements of nitrogen oxides at both Harwell and Adrigole commenced during 1974 in order to provide information on rural levels and a number of analyses for specific hydrocarbons were undertaken.

163. Measurements of peroxyacetyl nitrate (PAN), one of the products of photochemical smog responsible for eye irritation and plant damage, have been made both at Harwell and London (at the WSL site at Covent Garden) though weather conditions have not been conducive to its formation in 1974. To back up the field observations a number of laboratory studies have been made of important reactions in the very complex system present in photochemical smog. Computer simulation of the photochemical process has been studied.

164. The AERE has continued to study the atmospheric oxidation of sulphur dioxide both in photochemical and aqueous systems. A series of experiments carried out under the European COST programme has determined the photochemical oxidation rate in ambient air samples as a function of the initial hydrocarbon and nitrogen oxide concentrations. Work continues on other aspects of sulphur chemistry such as the fate of sulphur in soils and the chemistry of compounds such as dimethyl sulphide which may constitute a natural source of sulphur. Work on the dry deposition rate of sulphur dioxide has continued, with measurements over two grass fields, bare soil, a reservoir and a pine forest. The results, taken together with some obtained by the CEGB and the University of Nottingham give a good indication of the mean dry deposition rate for the UK. The work at the University of Nottingham (supported by CEGB) has involved measurements of the flux of SO_2 to wheat and soil over two seasons using micro-meteorological methods. Results for wheat show that surface effects appear to dominate over physiological effects, eg dew forms a good sink for SO_2 whereas a dry senescent crop removes SO_2 at only a slow rate.

165. Model studies of the behaviour of SO_2 in polluted atmospheres are under way at St Andrew's University (NERC grant), and reactions in the atmosphere between common air pollutants are being investigated (Lancaster University, NERC grant) particularly with regard to SO_2 and NO_2 in the Heysham area.

166. Deposition of S on to natural surfaces is being studied at the University of East Anglia (new NERC grant).

167. Some relevant studies of reaction kinetics and photochemistry are continuing at Oxford University (Physical Chemistry Laboratory), particularly of the photochemistry and reactions of ozone. This team is also concerned with the chemistry of minor constituents in the stratosphere in relation to the COMESA programme on effect of SST operations (see para 152). As in past years this work has been widely published.

168. CDE (Porton) is examining the concentration of pollutants from specified sources as a function of distance and weather conditions. Using a Freon which is known to persist in the atmosphere, as an internal standard for pollutant concentration measurements, the attenuation of concentration of other compounds can be determined as a function of distance from the source. In this way the relative importance of mechanisms such as adsorption by vegetation and wash-out by rain in the removal of atmospheric pollutants can be studied. Present studies are being carried out over distances of a few km but it is hoped to extend these distances once the analytical technique has been proved.

Part 4: Abatement of Emissions of Pollutants

169. Research work on methods for abatement of odorous emissions from "offensive and selected other trades" is currently claiming a high proportion of effort and funding. Warren Spring Laboratory is undertaking the majority of the investigational work, both at the Laboratory and at factory sites. Current funding is over £600,000 with DOE support at £440,000 and the balance provided from local authority and industry sources. Although the effort is primarily directed towards abatement of emissions from offensive trades, odours from works scheduled under the Alkali Act are not excluded.

170. In the solid fuel industry work is continuing on several aspects. Research and development work on fluid-

ised bed combustion at Coal Research Establishment, Stoke Orchard, is concentrating on smaller size industrial units, rather than the large power station field, and particularly in the area where conversion of oil-fired plant to coal-firing is constrained by physical volumes. Also at CRE the development of smokeless open fires using bituminous coals with downdraught combustion is continuing. Studies are in progress on methods for reducing emissions of particulate matter in coke oven plants (with particular emphasis on the working environment), and also on processes for producing low calorific value gas from coal for the purpose of gas turbine firing.

171. In the non-ferrous metal industry a programme of measurement of emissions from copper melting/recovery processes has been completed and the results are now being evaluated. This work was funded by DOE on behalf of HM Alkali and Clean Air Inspectorate and carried out by British Non-Ferrous Metals Research Association, (now BN-FM Technology Centre), with the purpose of assessing the need for any extended emission controls.

172. Continuous emission monitoring is being developed in several industries scheduled under the Alkali Act, and is aimed at securing more consistent control of emissions. As one example of this a continuous emission monitoring method for lead and cadmium is being developed by BN-FT C for the ACAI, and the prototype instrument is starting field trial.

173. Much of the continuing work on reduction of emissions for industrial scheduled processes is in the area of process or engineering development rather than in research. For example:

i. In the fletton brick industry a new kiln has been constructed incorporating the facility for withdrawal of kiln gases at selected parts of the process cycle, with the aim of evaluating any treatment methods that might prove suitable for reducing emissions.
ii. The CEGB is conducting field investigation studies into the mode of formation of acid soots in the flues and chimneys of oil-fired power stations.
iii. In the steel industry extensive studies are in progress, leading to the design of full scale equipment for collecting and treating spill fume released during the charging and tapping of large arc furnaces and basic oxygen steel converters.
iv. Intensive process development work in the chemical industry during 1974 has led to greatly reduced losses to the atmosphere of vinyl chloride monomer from the PVC manufacturing processes.
v. In the viscose rayon industry pilot plant has been installed in connection with studies aimed at improving the efficiency of the existing Ferrox process for reducing hydrogen sulphide emission.

174. Research into reduction of emissions from vehicle engines, including gas turbines, is continuing at several establishments. The abatement of lead emissions from petrol-engined vehicles by incorporation of a lead trap in the exhaust system has been investigated by MIRA, TRRL and WSL in collaboration. Performance was found to vary considerably with type of vehicle and with driving conditions, eg it was better in urban than in motorway situations. It was also found that lead accumulations in the trap could be emitted when conditions changed, especially when the vehicle was driven from an urban area on to a motorway. Mean reduction in lead emission during road tests was about 40 per cent of that from a standard exhaust system. There was no significant effect on power output nor on gaseous emissions, and the useful life of the trap materials compared very favourably with that of conventional exhaust systems.

175. A laboratory-scale investigation using simulated exhaust mixtures has been carried out at WSL to define the conditions necessary for optimum removal of exhaust pollutants using a single-bed catalytic system. The catalysts studied were doped iron oxide and supported noble metal types. The separate oxidation and reducing reactions which occur with various combinations of exhaust constituents in the presence of different initial oxygen concentrations have been examined to enable interpretation of the results of catalytic treatment of simulated exhaust containing all the constituents at realistic concentration levels. Commercial catalyst units have also been assessed on an engine-dynamometer facility using real exhausts arising from different air-fuel ratios.

176. The development of mathematical modelling techniques to predict ground level concentrations arising from specific emissions under various meteorological conditions, described in Part 3, should eventually provide a useful tool for evaluation of pollution control strategies.

ABBREVIATIONS

ACAI	Alkali and Clean Air Inspectorate.
ADAS	Agricultural Development and Advisory Service.
AERE	Atomic Energy Research Establishment.
ARC	Agricultural Research Council.
BGIRA	British Glass Industries Research Association.
BN-FMTC	British Non-Ferrous Metals Technology Centre.
BP	British Petroleum.
BRE	Building Research Establishment.
BSC	British Steel Corporation.
BSI	British Standards Institution.
CDE	Chemical Defence Establishment (Ministry of Defence).
CEC	Commission of the European Communities.
CEGB	Central Electricity Generating Board.
COMESA	Committee of Meteorological Effects on Stratospheric Aircraft.
CRE	Coal Research Establishment.
CUEP	Central Unit on Environmental Pollution (DOE).
DAFS	Department of Agriculture and Fisheries for Scotland.
DOE	Department of the Environment.
EBS	Emergency Bed Service.
EEC	European Economic Community.
GLC	Greater London Council.
GRI	Grassland Research Institute.
IC	Imperial College.
ICAPR	Interdepartmental Committee on Air Pollution Research.
IP	Institute of Petroleum.
ISO	International Standards Organisation.
ITE	Institute of Terrestrial Ecology.
LGC	Laboratory of the Government Chemist.
MAFF	Ministry of Agriculture, Fisheries and Food.
MIRA	Motor Industry Research Association.
MO	Meteorological Office.
MRC:APU	Medical Research Council, Air Pollution Unit.
MRE	Microbiological Research Establishment (Ministry of Defence).
MRF	Meteorological Research Flight.
NDIR	Non-dispersive infra-red.
NERC	Natural Environment Research Council.
NGTE	National Gas Turbine Establishment.
NPL	National Physical Laboratory.
OECD	Organisation for Economic Co-operation and Development.
PAN	Peroxyacetyl nitrate.
PVC	Polyvinyl chloride.
SDD	Scottish Development Department.
SIRA	Scientific Instruments Research Association.
SRC	Science Research Council.
SST	Supersonic transport.
TCM	(Sodium) tetrachloromercurate.
TRRL	Transport and Road Research Laboratory.
UKAEA	UK Atomic Energy Authority.
WHO	World Health Organisation.
WO	Welsh Office.
WSL	Warren Spring Laboratory.

The Warren Spring Laboratory of the Department of Industry

The two main areas of investigation by the Air Pollution Division at Warren Spring Laboratory are the measurement of air pollution and techniques for the control and reduction of air pollution levels. The programmes are mainly carried out in relation to the interests and responsibilities of the Department of the Environment and Local Authorities, industry, etc. Other Divisions at WSL are involved in the air pollution programmes as part of a wide range of environmental research covering also oil pollution and scrap and waste treatment.

The National Survey of Air Pollution

Warren Spring Laboratory has been responsible for the national surveillance of smoke and sulphur dioxide (and to a lesser extent grit and dust) on behalf of successive Government Departments administering clean air legislation. The Laboratory co-ordinates and standardises the voluntary efforts of Local Authorities and other bodies contributing to the National Survey and it centrally collates, disseminates and analyses the data produced.

There are now, summer 1975, 317 bodies making daily smoke or SO_2 observations at 1143 sites. The survey is primarily of urban air pollution; only about 10% of the sites are in rural areas. In addition, monthly measurements of grit- and dust-fall are made with the British Standard Deposit Gauge by 107 Authorities at 496 sites. Monthly measurements are still made at 129 sites of the extent of reaction of sulphur compounds in the atmosphere with a standard lead dioxide surface. The Laboratory gives help and advice on all aspects of these co-operative investigations. In particular advice is given on the selection of sites.

The Annual Tables of air pollution measurements prepared by the Laboratory can be purchased by anyone concerned with air pollution problems. For smoke and sulphur dioxide, these Tables give, for each site and for each month of the year, the average concentration, the highest daily concentration and the number of days for which the concentration exceeded certain values: 250, 500 $\mu g/m^3$, etc. The seasonal and annual average figures are also given. Detailed daily data can be obtained from the computer records at WSL on payment. For grit- and dust-fall and for the lead dioxide sulphation rates the data for each month and the seasonal and annual averages are published.

A series of Reports has been prepared dealing with the National Survey of Air Pollution 1961-71. The five volumes of Reports covering the twelve statistical Regions of the United Kingdom have been published by HM Stationery Office, price £3·50-£6 each. The Reports provide a critical breakdown of the data by size of conurbation, site type, season, etc, showing the general trends of improvement in air pollution, but also highlighting those towns where concentrations were still undesirably high.

With the implementation of smoke control in various parts of the country and with other changes in heating habits, the originally defined "black" areas have ceased to be a useful guide to where effort is still needed in the control of smoke or sulphur dioxide pollution. This requirement has been met by the mapping by WSL of smoke and sulphur dioxide levels througout the whole country. The maps have been built up from National Survey and other data and they will also facilitate assessment of the potential implications of adopting various pollution levels as air quality objectives.

All Local Authorities and other organisations making measurements of air pollution within the National Survey are entitled to send representatives to the Standing Conference of Co-operating Bodies organised by the Laboratory. Other bodies may do so on payment of a subscription. This Conference meets twice yearly to discuss relevant air pollution matters. *327* bodies have appointed representatives to the Conference.

Extensions of National Air Pollution Surveillance

The DOE Monitoring Report issued in 1974 assigned to the Laboratory the task of conducting an exploratory survey of the content of various elements in airborne particles at twenty sites in urban areas throughout the UK. These stations are progressively being installed. The measured elements are: As, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Ti, V and Zn. Also proposed in the Monitoring Report and now in hand are the daily measurement of sulphate in suspended particulates at twenty urban sites and the deployment of three sets of instruments for measuring ozone, oxides of nitrogen and hydrocarbons. All monitoring activities are now under the guidance of the Air Pollution Monitoring Management Group which represents both central and local government and is chaired by DOE.

The Laboratory has been exploring the possibility of harmonising the monitoring efforts of the new Local Authorities and other bodies for pollutants other than those covered by the National Survey. As a first stage Local Authorities' current monitoring activities and future intentions have been assessed showing their substantial interest in heavy metals and vehicle pollution. Details of methods employed and the quality of data are now being sought. One of the objects is to see if a reliable body of additional information exists or can be developed which might be published by central government.

Other Surveys

For the Department of the Environment the Laboratory undertakes on a less than nation-wide basis surveys of emissions and ambient concentrations of industrial, vehicular and other pollutants. Short studies are also commissioned on repayment by Local Authorities.

Roadside Pollution—Five Towns Survey

Following its reassuring 1960's survey of carbon monoxide levels for over a year in six cities, Warren Spring Laboratory started in 1972 the monitoring of a number of pollutants in the busiest streets of five towns in the United Kingdom—London, Cardiff, Glasgow, Cambridge and Birmingham—for a period of five years. Levels of carbon monoxide, total hydrocarbons, lead and smoke, together with traffic density and meteorological data are measured at all sites. In addition, at two sites in London, one at the roadside and the other a background station, nitric oxide, nitrogen dioxide, gaseous sulphur compounds and ozone are continuously measured. The data are reduced and analysed off line at WSL by computer.

As before, the approach is to concentrate on situations in which the vehicle flow and street ventilation conditions are likely to lead to the highest levels of pollution. It should be possible to register any significant trends in pollution levels produced by varying traffic load, etc, or as a result of legislation on engine design, exhaust systems or fuel. Measurements in London have shown the frequency with which significant photochemical reactions can occur during a good summer and have contributed to the general knowledge of atmospheric chemistry in this country. The results are of value to medical researchers, and will be one of the bases for deciding on the possible need for further legislation both in the UK and the wider framework of the EEC. The results to 1975 are being summarised for planners and the general public.

Heavy Metals

Since 1972 the Laboratory has coordinated dust and soil sampling and analysis around a number of works operating both scheduled and unscheduled processes involving lead. In the Midlands it has been carrying out a survey of airborne metals in the vicinity of a number of metallurgical plants. A more detailed study of a works in another area has been sponsored jointly by DOE and the Health & Safety Executive.

Pollution Abatement

Odours

1975 saw the publication of the second and final report of the DOE Working Party on Odours from Offensive and Other Trades, chaired by Dr Valentin, Deputy Director of Warren Spring Laboratory. As a result of a recommendation in that report a substantial programme of research has been commissioned at WSL on the problems of assessing odours and their abatement by various methods. This research, which aims also to provide guidelines and codes of practice for these difficult industries, is financed principally by DOE but also substantially by industry and Local Authorities which are both represented on the programme's Steering Committee.

Vehicle Pollution

Since the work on vehicle lead filtration in 1974, the main emphasis on WSL work has been on the development and validation of test procedures for vehicle emission measurement. There has also been continuing work on the use of catalysts for exhaust clean-up. These projects have employed the Laboratory's static engine test rigs and roller dynamometer with their extensive analytical and control equipment.

Air Pollution Control through Planning

Without actual reduction of pollutant emissions it is possible to minimise their effects by careful siting by the use of appropriate chimneys etc. Work in this field at WSL includes advice on chimney heights where the situation is more complex than can be covered by the Chimney Height Memorandum. For even more complex built up areas emission distributions are physically modelled in one of two wind tunnels. Studies include flats, offices and hospitals as well as industrial installations and the positioning of vehicle exhausts. For larger areas, particularly for development planning purposes, the Laboratory applies mathematical models to relate pollution levels and weather data to the detailed patterns of emissions. With these models it is possible to predict the effect of new developments on pollution levels. The Upper Forth Estuary Study for the Scottish Development Department, the main project of this type, has recently been extended and intensified.

International Collaboration

The pollution measurements in the UK (organised by WSL) for the OECD study of the Long Range Transport of Air Pollution were completed in 1975. The final report on this nine nation project should be issued in 1976. Its aim is to quantify the contributions to deposited sulphur pollution from near and distant sources.

WSL's measurements of the flux of sulphur compounds over the North Sea have been analysed and reported.

Within the European Community there is now official collection of data from the member states on smoke and sulphur dioxide pollution levels. WSL supplies data from around 100 UK sites. The Laboratory also takes part in the Commission's groups of experts assessing air quality in the Community and seeking to define criteria for the effects of various pollutants on health.

The Laboratory's work on the development and harmonisation of monitoring methods involves collaboration with UNEP, WHO, OECD, EEC and ISO (on behalf of BSI).

Research Undertaken by the Department of Fuel and Combustion Science, The University of Leeds

Air Pollution resulting from Combustion

(i) Studies of the formation of NOx in methane and oil flames.
(Professor A. Williams).

(ii) Studies of Urban Visibility.
(Professor A. Williams, Dr. A. G. Clarke and Dr. W. A. Gray).

(iii) Concentrations of polynuclear aromatic compounds in combustion products and urban areas.
(Mr. S. C. Mitchell).

Combustion—generated noise

Studies of noise resulting from combustion processes.

Study of Dispersion of Chimney Gases in order to Minimise Pollution by correct Design and Siting of Chimneys

Mathematical modelling of high and low level emissions.
(Dr. M. T. Jacques).

Distribution of Pollution in Urban Areas, etc.

Analysis of pollution trends in the City of Leeds, measurements of NOx ,SO_2, smoke and photochemical oxidants; kerbside monitoring of vehicle emissions; urban models of pollution.
(Professor A. Williams, Dr. M. T. Jacques, in conjunction with the Local Authority).

The Medical Research Council's Air Pollution Unit

The following notes describe briefly the current work on air pollution being done by the M.R.C. at St. Bartholomew's Hospital Medical College. For convenience the work is described in outline under various headings but it will be realised that the method of presentation does not mean that the topics are being investigated in isolation. The various investigations are highly integrated and it should be stressed that there is excellent liaison between the M.R.C. Air Pollution Unit, other M.R.C. units and outside bodies. The Unit has been designated as the World Health Organisation International Reference Centre on Clinical and Epidemiological Aspects of Air Pollution.

Chemical and Physical Nature of Pollutants

As a prerequisite to the proper study of the effects of pollution much work is still being done on the chemical and physical nature of pollutants and methods for their determination.

The changing relationship between black pollution and concentration of pollution in terms of mass is being investigated, and the efficiencies of several types of filter media have been determined with the collection of very fine airborne material in mind.

With the reduced amount of black pollution the measurement of reflectance from soiled filters has become more difficult. An extremely sensitive A.C. reflectometer has been constructed, which, when used with the specially developed sampling head readily gives reading of reflectance of the faintest stains. This instrument can be used to give readings for very low concentrations of some gaseous pollutants.

Studies on Carcinogens

Our interest in 3:4-benzpyrene and other polycyclic hydrocarbons is declining since their concentrations are decreasing and there is little evidence now that these compounds as urban air pollutants are associated with lung cancer. Some studies on the stability of these hydrocarbons have shown that some of them appear to be destroyed by ultraviolet light and nitrogen dioxide. Investigation into the sources of polycyclics has shown that the relative proportion of certain hydrocarbons can vary; using a ratio of coronene to 1:2-benzpyrene (two stable hydrocarbons) it has been possible by analysing samples of collected smoke to identify sources of hydrocarbons such as coal fires and motor vehicles. A study into the production of hydrocarbons from burning fuels has shown that the above hydrocarbon ratio increases markedly as the combustion efficiency increases.

Acid Particles

Acid particles, which may be of clinical significance, are very common in town air. Their source at times of low pollution appears to be the efficient combustion of fuels; past records show that at times of high pollution synthesis of acid takes place and that high concentrations of sulphur dioxide and smoke occurring together are important for the formation of much particulate acid.

Lead

Much work is being done on airborne lead from various sources. Trends in concentration, at different sites, of particulate and gaseous lead compounds are being assessed at various sites and their solubilities in various body fluids are being studied. Measurements of blood lead are being made in selected population groups in relation to exposure of lead from traffic sources and the wider range of lead sources in the environment.

Electron Microscopy

Work is continuing on the depiction and identification of particulate pollutants by electron microscopy and electron diffraction, special attention being paid to asbestos and lead.

The site of deposition and degree of retention of particles in the respiratory tract depend on many factors among which are size and shape. Much work is being done on the electron microscopic appearance of particles in engine exhausts under different engine operational conditions and to relate these appearances to those particles found in streets and motorways. Special attention is being paid to the distribution of lead in particles with special reference to its biological availability.

Physics of the Lung and Measurement of its Function

The fundamental study of the lung as a physical system is enabling us to reassess the methods of measuring its function in health and disease. In the past, studies to determine the physiological effects of environmental pollutants have been hampered by the lack of a very sensitive test to assess the effects of respiratory insult, and as part of the search for a more refined technique, we are developing new methods of assessing respiratory function. The analysis of continuous respiratory waveforms is being studied using the unit's own on-line digital computer to process the physiological data.

The breathing signal is monitored with a simple strain gauge sensitive to changes in thoracic or abdominal circumference. Basic characteristics of each breath contained within a record of this signal are measured and the data are presented in graphical form on a visual display unit. The simple displays and mathematical transformations of them are used for comparing records of normal breathing obtained from human subjects before and after exposure to realistic concentrations of the common bronchospasm producing air pollutants. A model of this purely pneumatic aspect of the respiratory system is being developed.

Studies of Acute Effects of Inhalation of Pollutants

Very many combinations of gases and aerosols of different composition have been inhaled in order to study their effects on pulmonary function. Some of the healthy volunteer subjects have been shown to respond to realistic concentrations of sulphur dioxide in the laboratory, following forced respiratory manoeuvres.

At the beginning of a long series of daily measurements of airway resistance following exercise in the prevailing pollution in central London some correlation with pollution was found, and further results are being studied carefully.

Daily measurements of ventilatory function have been made for a five-year period on healthy volunteers, but no consistent relation with pollution has been found. However, there is some evidence of transient effects in periods of high pollution, particularly after exercise. From an extension of this study, a correlation has been found for one individual between the change in peak flow on entering London each morning and pollution. Some evidence of changes in peak flow in relation to pollution has also been obtained from long series of measurements on bronchitic patients.

Currently the effect on human subjects of gases and aerosols which may be found in the ambient air are being reassessed, using new tests of pulmonary function relating especially to possible changes in small airways.

Carbon Monoxide

Because of the many sources of carbon monoxide, its varying concentrations in air, and the fact that its absorption depends on exercise and time, the measurement of carboxyhaemoglobin is greatly to be preferred to measurement of CO in air. The simpler indirect methods of measuring carboxyhaemoglobin such as the measurement of alveolar air are being tested; this involves simply analysing carbon monoxide in exhaled air after breath-holding.

Following the development of a micro-method for determining CO in blood, surveys of blood levels have been made in people exposed occupationally or experimentally to traffic. These have shown, so far, that levels above 4% saturation with carboxy-haemoglobin are rarely attained in non-smokers but levels higher than this (not uncommonly greater than 10%) are frequent in smokers. These surveys are being extended.

Experimental work is being done on the possible effects of carbon monoxide, producing a saturation of up to 10%, on the performance of fine tasks and on vigilance. So far, the results have shown no perceptible effects of such saturations on flicker and flutter fusion thresholds. These experiments have been extended so that the possible effects of diluted whole petrol and diesel exhausts on delicate tests of perception and performances can be examined. The effects have been demonstrated.

Pathology

We are perfecting a technique for assessing lungs received from operations or autopsies which will indicate the effects pollution has had on the large airways, the small airways, and the respiratory part of the lung, and the distribution of inhaled pigment. We are now looking at specimens from rural, urban and industrial populations, considering smokers and non-smokers separately.

We are also studying the three dimensional anatomy of the respiratory part of the lung and that of lung tumours, together with the pollution history (domicile, occupation, respiratory diseases, smoking) of the patients from whom specimens have been removed surgically. The technical problems of preparing such lungs for quantitative assessment are also being tackled. The relevance of this fundamental work to the genesis of disease in relation to air pollution is obvious.

Bacteriology, Effects of Pollutants on Lung Flora

It has been suggested that pollution in town air is responsible for the greater prevalence of chronic bronchitis in towns compared with country districts. As part of our investigations into the possible relationship between air pollution and bronchitis we have been studying the effects (in vitro) of particulate pollutants collected from London air on the growth of some organisms found in the respiratory tract—Strep, viridans and Staph. aureus—and those commonly recovered from the sputum of patients with chronic bronchitis—Strep. pneumoniac and H. influenzae.

Epidemiology

Trends in pollution in London are still being followed carefully: since the 1950's the average concentration of smoke has fallen by about 80%, and that of sulphur dioxide by about 50%, although there is now little further change from year-to-year. The most interesting feature as far as acute effects on health are concerned has been the virtual disappearance of episodes of high pollution, and by now it seems likely that this is a real change brought about at least partly by the removal of the "blanket" of smoke over London, that at one time prevented the sun from breaking up temperature inversions.

Studies of day-to-day changes in the condition of bronchitic patients are continuing. These have already shown a marked reduction in acute effects of pollution following the implementation of the Clean Air Act, and current results are being related to a wider range of environmental variables.

Now that there is no longer any clear evidence of sudden increases in hospital admissions or deaths in London in relation to pollution, more detailed studies are being undertaken in which these morbidity and mortality data are being analysed by cause and by age to see whether the effects of influenza epidemics, pollution, cold spells and other environmental factors either interact or are cumulative. Tabulations of daily deaths have now been obtained for other parts of the country, so that these studies can be extended to areas where the reduction in smoke concentrations has not been as great as in London.

The role of pollution as a contributory factor in the development of chronic bronchitis is being investigated in a number of ways. There are encouraging signs from the trends in bronchitis mortality that reductions in pollution may be having a beneficial effect, initially in London, but extending gradually to other urban areas. To separate effects of pollution from those of other relevant factors (notably smoking) it is however necessary to conduct special surveys. In a study in London, early symptoms of respiratory disease among 18-year-olds were examined, comparing in particular a group born just before the fog of December 1952 with one born just after it. The results indicate that this single episode had no dominant effect, but further studies are planned to assess whether continued exposure to high levels of pollution during childhood had adverse effects on the group as a whole. New spirometric techniques have been developed to allow a much wider range of ventilatory measurements to be made in future surveys. A longitudinal study of a group of medical students first seen at age 19 is being continued, and detailed pulmonary function studies have now been made on them for the third time. "Cross-sectional" studies of peak flow are also being made among office workers in the City of London, linking the results with smoking habits and area of residence.

Studies of lung cancer mortality now show that the rise in death rates among men is gradually drawing to a halt, whilst the rates for women are still increasing. The general trends are related to changes in smoking habits, but signs of a reduction in male death rates are appearing in London, sooner than in other parts of the country, and it is possible that reductions in pollution are playing some part in this.

The Atomic Energy Research Establishment

The Harwell atmospheric pollution programme is essentially long term aimed at understanding the life-history and fate of pollutants in the atmosphere. This involves mainly consideration of the atmospheric chemistry of pollutants and the mechanisms, such as deposition and rain-out, responsible for their removal. The principal areas of interest at present are the life cycle and long distance transport of sulphur compounds in the atmosphere, atmospherical photochemical mechanisms leading to oxidant formation and other effects, oxides of nitrogen, fluorocarbons and halocarbons, and lead aerosols from petrol engine exhaust. Three projects, one on the oxidation of sulphur dioxide in ambient air containing hydrocarbons and nitrogen oxides, one on the aqueous phase oxidation of sulphur dioxide, and the third on the dry deposition of sulphur dioxide, form the UK contribution to the COST (Co-operation Scientifique et Technique) project.

In addition, there is an environmental analysis project whose main objectives are: (a) the study of atmospheric particulate material, including the determination of its elemental and chemical composition, (b) the use of this information together with other studies to establish the origins and histories of the components of the material, (c) the study of the mechanisms and rates of deposition of the various components to the surface of the earth, and (d) the study of the destinations and ultimate fates of the various components in the earth's land and sea surface, including their uptake in and effects on living things. Research in progress includes the study of the enrichment of trace elements in the surface of the sea. The expertise built up in this field is now offered to local and regional health authorities, and other interested bodies, and Harwell will provide, on a repayment basis, a routine service for monitoring the concentration of a very wide range of environmentally significant elements in airborne dust, or their rates of deposition to the ground.

In the field of radioactivity, measurements have been made since 1953 of fallout in air and rainwater from nuclear test explosions to give early indications of changes in the levels of fallout which affect levels of dietary contamination.

Work of importance in radiation toxicology is in progress in which radioactive non-leachable mono-disperse particles are administered to human volunteer subjects to measure the uptake and clearance of particles of various sizes from the lungs; to study the effects of different breathing patterns and the uptake, localisation and clearance of particles from the nose.

Radioactive tracer techniques have been developed to study the deposition pattern of asbestos fibre inhaled by the rat and its subsequent clearance. Using information on alveolar deposition obtained from this programme, work is in progress to determine the minimum amount of various types of asbestos required to induce lung fibrosis in a given time. Other work includes investigations of the relative importance of various physical and chemical factors in determining the effect of asbestos and other mineral dusts on biological systems.

The progress of work on these topics is published in the annual report of the Environmental and Medical Sciences Division.

LIFE CYCLE OF SULPHUR COMPOUNDS IN THE ATMOSPHERE

Sulphur is released to the atmosphere largely as a result of burning fossil fuels. During its passage through the atmosphere it can undergo reaction with one or the other components of ambient air and be converted to a range of products each of which may have a different effect on man and the biosphere. To enable decisions to be made on the control of emissions it is necessary to investigate the factors controlling the reactions and fate of airborne sulphur compounds. The magnitude of the natural sources is also of importance in determining the significance of man's contribution to the environment. Work on the following projects has been undertaken to elucidate these problems:

Dry deposition of sulphur dioxide

The rate at which sulphur dioxide is deposited on to soil, grass, crops and similar surfaces has been extensively investigated. The results show that there is not a great deal of variation in the value of the deposition velocity over surfaces of this type for which a mean figure of 0·85 cm sec^{-1} may be used with reasonable confidence. This value enables an estimate to be made of 30% for the fraction of sulphur dioxide emitted in this country which is deposited on the soil and other surfaces before being carried away from Britain by the wind. Such data is of basic importance in deriving the contribution which the United Kingdom makes to the long-range travel of sulphur dioxide to Scandinavia, concerning which the OECD has sponsored an international co-operative exercise now entering its third year. Data of this kind is now considered largely complete, except for deposition to forested areas and to surfaces covered with snow or ice, both of which are important in the Scandinavian context.

Calculation of the main fraction of sulphur dioxide deposited also requires knowledge of the vertical distribution of sulphur dioxide in the atmosphere over the United Kingdom and this has been determined in a number of experiments, now completed, using specially developed sulphur dioxide samplers suspended from a cable of a balloon.

Such calculations are also supported by direct measurements made in conjunction with the Meteorological Office and using aircraft sampling to determine the flux of sulphur dioxide leaving the country for comparison with the known emission rate.

Oxidation of sulphur dioxide

Sulphur dioxide can be oxidised to sulphuric acid or sulphates in the atmosphere in several ways which have been studied at Harwell. This process is important since the oxidation products can have greater deleterious effects on health and amenity (e.g. reduction in visibility) than sulphur dioxide itself. A major effort has been devoted to the study of the photochemical mechanisms of sulphur dioxide oxidation in the atmosphere as a result of which this process is now quite well understood. It has been shown that the direct photo-oxidation of sulphur dioxide occurs at too low a rate to be of importance in the atmosphere. However, photo-oxidation in the presence of hydrocarbons and oxides of nitrogen, both of which are emitted in vehicle exhaust, occurs at a significant rate. Details of this process have been to a considerable extent worked out and the importance of oxidation by the hydroxyl radical established, though there is still some doubt as to the intermediate steps in the oxidation. This work has also included experiments using samples of outside air enclosed in transparent plastic bags and exposed to sunlight which enable a realistic figure for the oxidation rate in the real atmosphere to be obtained, which is difficult to determine from experiments with simulated atmospheres. This work, which forms part of the COST 61A Project, is now nearly complete except for a comparison with a computer simulation of the processes involved, to be carried out shortly.

Extensive studies have also been made of the oxidation processes occurring in aqueous solution because of their importance for the washout of sulphur dioxide from the atmosphere. These have included basic studies of the oxidation rate of oxygen in solution using a stop-flow apparatus, and also studies of ozone both in this system and in an artificial fog chamber. Other work has involved oxidation in samples of rain collected from various places in the country in an attempt to understand the role of catalytic metals such as manganese and iron. These have shown that the oxidation process is more complicated than might be assumed from laboratory studies using synthetic solutions of metal ions but also on a quantitative basis, the metal ion catalysed process is insufficiently rapid to explain the amount of oxidation of sulphur dioxide that occurs, with the possible exception of plumes and highly polluted areas where the catalyst concentration is very high. The effect of ammonia on the oxidation rate, which at one time appeared to be the controlling factor in the oxidation, has now been shown to be only of minor importance. At the present time the most important oxidation process appears to be that involving ozone in aqueous solution. Further studies on this and some related mechanisms will be needed before a full understanding is gained. Compared with the photochemical oxidation of sulphur dioxide, the aqueous process, despite a longer history of work, are still not well understood.

As well as the oxidation of sulphur dioxide itself, that of other gaseous sulphur compounds is of importance in understanding the natural cycle of sulphur in the atmosphere. The magnitude of the natural sulphur cycle in relation to the sulphur emitted by man's activities is of great importance in assessing the impact of the latter on the environment. The homogeneous oxidation rates of hydrogen sulphide, methyl mercaptan and dimethyl sulphide has, therefore, been investigated. We have demonstrated that, like sulphur dioxide, the most important oxidation mechanism involves attack by the hydroxyl radical and the reaction rates have been determined.

PHOTOCHEMICAL SMOG

Work in this area is designed to show the extent of present and potential photochemical smog formation in the United Kingdom, to understand the complex sequence of chemical reaction involved and thereby, with the use of computer models, to make predictions of both the need for controlling motor vehicle emissions and the consequences of various possible control strategies.

Monitoring of photochemically produced ozone in the atmosphere has been carried out both at Harwell and at a remote site in the south west of Ireland. This has demonstrated the occurrence of measurable amounts of photochemical pollution in this country, though the maximum levels so far observed are below those at which overt symptoms such as eye irritation, become obvious. However, there is no doubt that even in this country photochemical pollution has a deleterious effect on visibility. Our work has shown that the distribution of photochemical pollution differs from that of the traditional pollutants such as smoke and sulphur dioxide. This is because the damaging components of the pollution are only formed after a period of some hours in the atmosphere by which time the air masses involved have dispersed some distance from the primary source of nitrogen oxide and hydrocarbon pollution. Thus levels of photochemically produced ozone measured at Harwell, in a relatively rural situation, are much the same as those in central London and we have even found that the incidence of elevated ozone levels in south west Ireland is similar. This undoubtedly is due to the long-range transport of photochemical pollution from continental Europe and Britain and establishes the necessity for any control action to be taken on an international rather than simply a national basis.

Considerable effort has been devoted to measuring the reaction rate constants of the many individual reactions involved in the overall photochemical process. Much of this work involves the reactions of the hydroxyl radical which is a key species in the overall reaction system and a new chemical system, involving the photolysis of nitrous acid, has been developed and exploited for this purpose.

In addition to ozone there are other products of the photochemical reaction with important effects. One of these is PAN (peroxyacetylnitrate)) which is thought to be responsible for much of the lachrymatory effect of photochemical pollution and is also an important phytotoxic agent. The formation of this substance in the system has been investigated in the laboratory and automatic equipment has been devised for its measurement, both at Harwell and in central London. A measurement of PAN may provide a more reliable estimate of the intensity of photochemical pollution than ozone, since the latter is also formed in significant amounts by purely natural processes. Other minor products of the chemical reaction have also been measured in order to assist in the elucidation of the complex chemistry involved and to validate the computer simulations of the system which have been made.

The simulations, which have so far been confined to the chemical aspects of the problem without the introduction of any meteorological factors, involve the solution of a large number of simultaneous differential equations describing more than eighty reactions which take place. Powerful computer techniques for the solution of such problems have been developed elsewhere at Harwell and use of these has enabled rapid progress to be made so that we are already able to simulate adequately the natural atmosphere and in a generalised way, both the urban and rural situations. Studies of the effects of various control measures have also been made and the advantage of controlling primarily hydrocarbon emissions has been demonstrated. Further kinetic measurements of the chemical reactions involved, the determination of some important minor constituents in the atmosphere and further development of the computer modelling are required to make quantitative predictions of the effects of control measures.

OXIDES OF NITROGEN

The life history of nitrogen oxides in the lower atmosphere is closely connected with the reactions involved in the photochemical pollution system, even when the concentrations of pollutants are sufficiently low that no obvious evidence of photochemical activity is present. A good deal of information has been obtained as part of the studies on photochemical pollution, and for example, the formation of nitrate in the atmosphere as an end product of the photochemical reactions is now understood. However, the wider details of the nitrogen oxide cycle, in particular the strength and nature of the natural source and the other sinks in the atmosphere are still very imperfectly known. Nitrogen oxide emissions are increasing in this country and they make a contribution to acid deposition which causes so much concern in Scandinavia, so it is important to understand the nitrogen oxide life history for much the same reasons as for sulphur dioxide.

FLUOROCARBONS AND HALOCARBONS

This topic which arises out of concern for the effects of relatively stable chlorine compounds in the atmosphere on the amount of ozone present in the stratosphere, which acts as a screen for biologically harmful ultraviolet radiation, was added to the programme only during the past year. Already considerable progress has been made in the development of measurement techniques for fluorocarbons and halocarbons in the atmosphere which will be used for determining the vertical profile in the atmosphere by means of aircraft sampling. Laboratory measurements have also been made of the rate of attack of hydroxyl radical on a range of halocarbons which are found in the atmosphere as well as the fluorocarbons towards which most attention has so far been directed. This rate constant determines the lifetime of halocarbons in the atmosphere and the extent to which they contribute chlorine to those parts of the stratosphere where it can catalyse the destruction of ozone. Calculation of the extent to which this occurs, both for halocarbons and fluorocarbons, requires a complicated photochemical model similar to that developed for the photochemistry of the troposphere but in addition the transport processes occurring in the stratosphere have to be included. Such a model has been developed, again taking advantage of the advanced computer facilities available at Harwell, and the first results are being obtained.

LEAD

A large fraction of the lead in the atmosphere is derived from the use of tetra-ethyl lead in petrol. The lead is emitted from the exhaust systems of petrol engined vehicles as small particles, which can enter the body by inhalation or can deposit on crops which are consumed by grazing animals. Methods have been developed for producing a lead aerosol from a small petrol engine (so as to reproduce as closely as possible the chemical/physical form of lead aerosols produced from a vehicle exhaust in the atmosphere) which is tagged with radioactive lead so as to make a number of experimental investigations possible.

The radioactive lead aerosol has also been inhaled by human volunteers and the percentage deposition in the lung, uptake to blood, and excretion of the labelled lead were measured. The percentage deposition in the lung depended on the length of the respiratory cycle. Most of the radioactive lead was removed from the lung with a half-life of about six hours. About half of the amount deposited in the lung was in the blood at 50 hours after inhalation. From this and other evidence it is deduced that most of the lead passed from the lung to the blood plasma. About half was removed to bone and other tissues, and half became attached to red cells. From about 72 hours onwards the amount of radioactive lead in blood declined with a biological half life of sixteen days. Assuming that the same half-life applies beyond the period for which measurements were made, the results can be used to predict that an exposure of twenty-four hours per day to one microgram per cubic metre of exhaust lead over a period of months will give an average contribution to blood lead of about 1 microgram per hundred millilitres.

A theoretical paper on the travel and deposition of lead aerosols has been written which treats the lead emission from a moving vehicle as a line source. Theoretical calculations of the lead in air at various distances from roads with given traffic density appear to be in good agreement with published data and should help in determining questions of land use close to roads.

The paper also assembled data on lead in vegetation in relation to fall-out which was used to estimate the rate of fall-out of lead near the Avon Smelter from measurements of lead in grass. The estimates made this way were in good agreement with those determined by deposit gauge measurements.

TRACE ELEMENTS IN AIR AND RAINWATER

Trace elements in the atmosphere can be considered as (a) nutrients, (b) potentially toxic pollutants, and (c) as tracers of transfer mechanisms. The background levels of trace elements and the natural and unnatural variations about these levels are being measured to observe the passage of trace elements through the environment. Harwell carry out a national project to measure and interpret the levels of some 30 stable elements in rainfall and airborne dust at seven stations in non-urban areas.

The preferred method of analysis was instrumental neutron activation using automatic gamma ray spectrometry, with support from other techniques, mainly X-ray fluorescence and atomic absorption. From the basic measurements three derived parameters were calculated; enrichment factor (Ef) which is the ratio of an element to scandium in the media analysed relative to the ratio of the same elements in soil; dry position velocity (Vg) that relates to particle size; and washout factor (W) that relates to the efficiency of removal from the atmosphere by rain.

Levels of chlorine, sulphur (as SO_4^{2-}), and nitrogen (as NO_3^- and NH_4^+) usually exceeded 1000 ng per kilogram of air, and next in decreasing order of concentration were sodium, iron, aluminium, zinc and lead. Elements usually present at 1-50 ng per kilogram of air were vanadium, chromium, manganese, nickel, copper, arsenic, selenium, bromine, cadmium and antimony. The group whose concentration were less than 1 ng per kilogram of air included scandium, cobalt, mercury and thorium. Absolute concentrations in air varied between sites and generally increased during the winter. However, relative proportions of elements in the airborne particulate were similar on average at widely separated locations, resulting in general chemical uniformity. In rainwater and dry deposit, elements followed a similar order of concentration to air. Average annual concentrations in all media from individual sites were similar in 1972 and 1973, except for higher bromine levels in the winter of 1973. Maritime and industrial origins for this extra bromine were precluded by the elevated ratios of bromine to sodium and to lead in air, greater than reported for bulk seawater and for ethyl fluid added to petrol. A volcanic origin for the excess bromine may be possible, since the period of higher bromine levels coincided with volcanic activity in Iceland.

Elements with moderate to high enrichment factors in air compared with soil were vanadium, chromium, cobalt, nickel, zinc, arsenic, selenium, antimony and lead suggesting industrial origin. Enrichment factors close to unity were recorded for aluminium, manganese, iron, cerium and thorium which were considered to have a direct terrestrial source. Enrichment was inversely related to particle size and Vg. At a maritime station all elements showed unusually high deposition velocity and washout.

The total deposit was largely water soluble for elements with high enrichment factors in air. Least solubility was shown by aluminium, scandium, iron, cerium and thorium, all elements of low enrichment, and this group also had the highest proportion of dry to total deposit.

Significant linear correlations between pairs of elements in all media were observed, frequently at four or more sites. Element-pair correlations were more numerous in air; by grouping according to enrichment factors and deposition velocities their possible origins (maritime, industrial and terrestrial) were indicated. Correlation of air concentrations and wind direction was made at one station for certain elements.

An attempt has been made to estimate the atmospheric input of trace elements including heavy metals, into the North Sea, and into the Clyde Sea and to compare these estimates with the amounts thought to be present in these seas. It is shown that each year the atmospheric contribution to the North Sea compared with that thought to be present in the sea is about 50% for iron, about 30% for lead, 20% for zinc, 10% for copper, manganese and cobalt and less than 5% for cadmium, mercury and nickel. The atmospheric input into the Clyde Sea is also shown to be significant although fewer data for the content of the Clyde Sea are available for comparative purposes.

Work is also in progress for the Natural Environment Research Council with the following objectives (a) to investigate the existence of sea-surface enrichment and also its magnitude, (b) to investigate the mechanisms of enrichment, (c) to study the transfer of trace elements at the sea-air interface, and (d) to study the contribution of the sea to the worldwide transport of trace elements.

Intensive environmental programmes have also been carried out for the Welsh Office and for local authorities. For the Welsh Office contract continuous measurements were made for one year of atmospheric concentrations and deposition rates for eleven specified elements at eight sampling stations in the Swansea area. Local authorities for whom environmental programmes are being carried out include the London Boroughs of Brent and Havering, the City of Manchester, Trafford Metropolitan Borough, Blyth Valley and Selby.

RADIOACTIVE FALLOUT

Rainwater is collected at eight stations in the United Kingdom and at 20 stations elsewhere from Tromso (70°N) in Norway to Halley Bay (76°S) in Antarctica. Airborne dust is sampled at ground level at five sites in the United Kingdom and at four sites overseas. The radioactivity in the samples is mainly measured by gamma-ray spectrometry and analysed by computer. These measurements provide an inventory of the radioactivity from nuclear test explosions and give early indications of changes in the levels of fallout which affect levels of dietary contamination. The interpretation of the data also provides information relevant to the world-wide transport of pollutants generally.

INHALATION STUDIES

The primary objective of this programme is the acquisition of basic information on the deposition of inhaled particles in, and the clearance of deposited material from the human respiratory tract. Systematic studies have been made of the effect of particle size and flow-rate on the deposition of radioactivity labelled spherical particles of unit density in the nasal passages of volunteers. The clearance of particles deposited on both the ciliated and non-ciliated regions of the nasal mucosa have also been studied. Rather similar techniques have been used to demonstrate impairment of nasal mucociliary clearance in woodworkers in the furniture industry. Currently, experiments are being carried out to study the effect of particle size and breathing pattern on deposition in the tracheobronchial and pulmonary regions of the human respiratory tract.

Initial results with ten mouth-breathing sedentary subjects give average values for the total and regional deposition of particles with diameters 2·5, 5·0 and 7·5 μm. A large subject-to-subject variation was observed and the experiments are being extended to cover a larger number of volunteers and breathing conditions.

ASBESTOS

Work is in progress to study the fate of inhaled asbestos particles of various sizes, shape and chemical composition in order to determine more precisely the quantities and sites of initial deposition, changes within the body and later retention. Inhalation experiments, using rats, have been carried out with the standard reference samples of asbestos which have been made radioactive. The radioactivity enables the initial pattern of deposition in the various regions of the respiratory and gastro-intestinal tracts to be determined. Autoradiographic techniques enable individual fibres to be located in thin lung sections, and show the distribution of fibre in whole lung sections.

The Central Electricity Generating Board

The main sources of air pollution from the operations of the Generating Board are the products of combustion of coal and oil. These are considered under the headings of: separation of solids from gases; dust measurement; disposal of solids; dispersion of gases.

Separation of Solids from Gases

Both the older and more modern pulverised fuel plants rely on electrostatic precipitation as the final or only stage of separation of particulate matter from flue gases. A research programme has revealed unexpected deficiencies in gas distribution, in rapping and in power supplies in some older plants. As soon as this research can be applied to individual plants, the deficiencies are being made good. Poor gas distribution leads to reduced efficiency because the greater efficiency of dust removal in a starved channel does not fully compensate for the reduced efficiency in an overloaded one; when, by means of velocity measurements and model techniques, the gas flow has been analysed, baffles can be designed and inserted to smooth the flow. Rapping impulses by means of which the collected dust is removed from the precipitator electrodes, have been found by actual measurement with accelerometers to be much attenuated if transferred from one member, such as a holding frame, to another, such as the plate or wire itself. Research on optimum electrical sub-division of the precipitator has shown the need for maintaining maximum power supply to each section and the importance of correct electrode spacing to reduce flashover.

Statistical analysis of the results of efficiency tests has shown the relative contribution to efficiency of such factors as size of precipitator, degree of sub-division, specific collecting area, power input, and the characteristics of the ash and the coal. It is clear that too low a sulphur content impairs collecting efficiency by making the particles electrically non-conducting, but no simple practical means of increasing the effective sulphur content of the ash from low-sulphur coals has been developed for routine application.

Dust Measurement

An important part of a dust-arresting installation is some means of informing the operator of any failure to function correctly. The pollution by dust at ground level is caused in the main by particles in the range from $20\mu m$ upwards, and an instrument has therefore been developed known as the CERL Dust Monitor which gives a continuous record of the emission of these coarser particles which are not recorded by instruments used to measure the emission of smoke. The CERL Dust Monitor has recently been redesigned.

The Mark II instrument is now commercially available, it has given a very reliable performance in Power Stations and is being tried out in other industries, including cement and iron works.

The nuisance from excessive emissions is a function of total output over a period of time, and integrators for the sum of the readings of all instruments in a power station over an eight-hour shift period are available.

The Mk. II instrument does not purport to deal with the very fine ash and black smoke particles which have a size less than 20 micrometers. These particles are, however, objectionable because of their appearance in the atmosphere. Smoke meters (sometimes referred to as opacimeters) are mainly influenced by the finest particles and provided they are designed with sufficient zero stability and sufficient sensitivity can give a valuable guide to the emission of fine dust and black smoke. An instrument which can be inserted from one side of a duct and removed for a manual check of zero has been developed, and is commercially available. An instrument with an automatic zero check has been developed and is under test.

Because it was thought that the standard deposit gauge had a limited application to modern dust problems, a new type of gauge has been developed for measuring dust in the field known as CERL Directional Dust Gauge. This has been used in routine measurements around a number of modern power stations and its directional characteristics are considered to be of considerable assistance in the interpretation of measured results. Its design has been modified to make it as cheap as possible to produce, and it is now covered by British Standard specification 1747 part 5 1972.

The conversion of smoke recording instrument reading to Ringelmann number has now been set out in an addendum to British Standard 2742 1969—addendum No. 1 1972.

Ash Disposal

Local air pollution can arise where dust which is handled or dumped is allowed to dry. Economical techniques of surface treatment are under investigation. There is a particular problem with cenospheres (floaters) on ash lagoons. These can dry on the surface layer and be picked up by the wind. A number of methods for dealing with this difficulty are now being investigated, from immobilising them *in situ* to harvesting them for industrial use.

Dispersion of Gases

Eight-port daily SO_2 samples are used routinely around power station sites for a number of years before and after commissioning of the stations. In addition a number of stations have been intensively instrumented using in each case about two dozen continuously recording SO_2 instruments and full meteorological instrumentation. The SO_2 recorders were developed about 10 years ago at CERL and have been successfully used in these surveys. The surveys have given excellent support to theoretical predictions and to the effectiveness of tall chimneys in controlling large-scale emissions of flue gas, as well as providing new knowledge on the particular influence of inversion layers above and below the chimney top. One important aspect of chimney height is now seen to lie in the proportion of inversions which are penetrated by the flue gases.

The Tilbury and West Burton investigations have been concluded. A further survey of this type is nearing completion at Eggborough which is the first 2000MW power station employing a single chimney. This survey has 25 SO_2 recorders and meteorological measurements which for the first time give details of atmospheric conditions up to 1,250 feet from the surface of the Earth. The use of a laser to measure the height of a plume, even though it is invisible to the eye, has been developed for some years at the Tilbury survey. This will continue to be used at Eggborough and its use will also be developed to study the temperature profile of the atmosphere in the range immediately above 1,250 feet. Observations of plume rise and ground level SO_2 concentration will also be made in due course at the Drax power station in Yorkshire, which has a single 850ft chimney designed for 4000MW of generating plant. Gas turbine plumes have also been studied.

Other Potential Problems

In recent years prominence has been given to claims by certain European countries that SO_2 emissions several hundred miles from their sources can adversely affect forests, agriculture and rivers by producing "acid rain". It has been widely acknowledged that insufficient scientific data are yet available to confirm or deny these claims and an international study of long-distance drift of SO_2 has been started under the auspices of OECD. The Generating Board is participating in the UK contribution to this work and in addition is making further studies of some relevant factors; such as the chemical reactions of SO_2 at low ambient concentrations and the rates of absorption of SO_2 at the surface of the earth. In a related field the extent to which low concentrations of atmospheric SO_2 may assist in meeting the essential sulphur requirements of growing plants is also under consideration.

SECTION 8

GUIDE TO PUBLICATIONS

Page

Films and Filmstrips 134

Recent Acquisitions to the NSCA Library 143

Guide to Publications 145

Films and Filmstrips

Following is a list of films and filmstrips on varied pollution and environmental aspects. Application for the loan of films should be made to the issuing organisation referred to in the lists.

The films are on free loan unless hire charges are quoted. Two or three weeks' advanced notice of hire should be given. The running time of films in minutes is included. Please note that 'sound' films should never be run on a silent projector.

The Society welcomes information on other films suitable for inclusion in future editions of the Year Book.

BRITISH GAS CORPORATION

The Air—My Enemy

The main theme is air contamination by smoke and SO_2, but other forms of pollution which cost Britain £400m a year are described. The success achieved in London is outlined. Research into better ways of using fuel is being carried out. One answer is natural gas, which produces no impurities—the domestic chimney is still an important source of atmospheric pollution.

Colour/sound 25 mins. 16mm

Kitchen Think

An animated cartoon sponsored by British Gas, with commentary written and narrated by Frank Muir. It provides a light-hearted look at the ways in which man has developed the place where cooking is done, from a prehistoric cave fire to the streamlined split-level kitchen of today. Also practical advice on how to plan a kitchen.

Colour 10 mins. 16mm

Sea Born Treasure

Vividly highlights the background to the discovery of the first major new indigenous source of power since coal; the progress made in bringing it ashore and the isolation and hardships endured by the crews of drilling rigs. Touches upon the connection this discovery of gas in the North Sea and the effect of its distribution may be expected to have on the national economy and the citizen.

Colour 25 mins. 16mm

The above films are available from:
Viscom Film Library
16 Paxton Place
London SE27 9SS
Tel: 01-670 5786

BRITISH MEDICAL ASSOCIATION

It Takes Your Breath Away

A review of the causes of 'dirty air' as produced by domestic and industrial smoke, traffic, etc. The effect on the lungs of living in this type of atmosphere is briefly shown and the film is of value to Public Health Workers as a means of ramming home the ill effects of a smoky atmosphere.

Colour 10 mins. 16mm £2 + VAT

Available from:
BMA/BLAT Film Library
BMA House
Tavistock Square
London WC1H 9JP
Tel: 01-387 4499

BRITISH PETROLEUM FILM LIBRARY

Clean Beaches

Of particular interest to National and Local Authorities concerned with oil pollution of beaches. The film shows some of the methods and equipment which have been developed in the last few years to deal with oil slicks at sea, and demonstrates methods of disposal should they reach the shore.

Colour/sound 14 mins. 16mm

Location North Sea

Shows the first drilling/production jacket, weighing 30,000 tons, being towed 250 miles out to B.P.'s Forties oilfield in the North Sea.

Colour/sound 16 mins. 16mm

Refining

A light-hearted film approach to the problem of explaining to a non-technical audience the basic principles of refining crude oil. A cartoon figure detaches himself from a party touring a refinery. He comments ironically on the formidable technical jargon used by the guide and explains humorously and in easily understood terms what the guide really means. 1968.

Colour/sound 18 mins. 16mm

The Shadows of Progress

A broadly based, international film which examines this affluent technological age and the crisis provoked by human expansion in a finite world. Air water and soil, space to live and the quality of life are all studied.

Colour/sound 14 mins. 16mm

The Tide of Traffic

Man now finds himself caught between the motor vehicle's massive benefits and the social and environmental problems brought about by the scale of its usage.

Colour/sound 29 mins. 16mm/35mm

Web of Life Series

Six films examining the ecological balance of the world's major systems: **The Living Lakes; The Living Mountains; The Living Rain Forest; The Living River; The Living Savanna; The Living Tundra.**

Colour/sound Each approx. 30 mins. long 16mm

The above films are available from:
The BP Film Library
15 Beaconsfield Road
London NW10 2LE
Tel: 01-451 1129

THE CENTRAL FILM LIBRARY

It's All Man Made

Environment is largely a matter of choice. We choose to pollute, to preserve, to raze or repair, to do something or to sit back. The river Trent, in its 128 mile journey to the sea, passes through almost every environmental problem which faces us.

'It's All Man Made', a film from the Department of Environment, presents its audience with evidence of past and present choosing as it follows the course of the Trent. It testifies to problems certainly, but also to effort and achievements.

There is now clean air over industrial Stoke, derelict land reclaimed, conflicting demands on a National Park successfully reconciled and Newark is facing up to the special problems of being an historic town. These are some of the elements in a gently persuasive film made for general audiences.

Colour/sound 28 mins. 16/35mm
Also stills available.

Available from:

The Central Film Library
Government Building
Bromyard Avenue
Acton
London W3 7JB
Tel: 01-743 5555

CEGB FILM LIBRARY

Change for Safety

Shows the nuclear safety rules being applied in a nuclear power station. Power station workers are depicted going about their normal business, adherence to the rules making them completely safe from the effects of any radiation. Different types of radiation are explained in diagrammatic form.

Colour 24 mins. 16mm/35mm

Electricity and the Environment

Pollution is one of the hazards of everyday life. The CEGB have their own pollution problems and this film shows in general terms the action taken to combat them. 1971.

Colour 22 mins. 16mm/35mm

Hardened Supporter

Demonstrates some of the many highly successful applications of pulverised fuel ash as a light-weight load-bearing landfill. Engineers and surveyors discuss on-site problems and how they are overcome by the use of PFA. 1968.

Colour 20 mins. 16mm

How Steam is Produced

Describes the production of steam in power stations using coal, oil and nuclear fuel. Animation is used extensively to show the complete sequence of operations, from the arrival of the fuel to the output of electricity.

Colour 18 mins. 16mm/35mm

How Electricity is Made (To follow How Steam is Produced)

Colour 21 mins. 16mm/35mm

The above films are available from:

The Central Electricity Generating Board Film Library
Sudbury House
15 Newgate Street
London EC1A 7AU
Tel: 01-248 1202

CLARKE CHAPMAN LTD.

Incineration—The Burning Question

Shows another method of refuse disposal and pinpoints the national problem of 17 million tons of refuse needing to be disposed of annually.

Colour 30 mins.

Available from:

Clarke Chapman Ltd.
International Combustion Division
Spring Road
Ettingshall
Wolverhampton
Staffs WV4 6JX
Tel: Bilston 41121

CONCORD FILMS COUNCIL LTD.

And on the Eighth Day . . .

Outstanding programme on the pollution of our environment, in four sections:

1. WATER: we all know about rivers, but the sea itself is being affected. Even with more advanced techniques of sewage disposal many problems remain, and industrial waste increases.

2. AIR: Even if the poisonous fumes could be eliminated there are the long-term effects of the building up of carbon dioxide which could have far-reaching effects on the life of the planet.

3. EARTH: Pesticides and chemicals applied to the soil are already causing concern in killing off wild life, but some fear that already the effects are disastrous and irreversible. The delicate balance on which life and our lives depend is being destroyed. Some American scientists, realising this, are being persecuted or at best ignored by big business interests who will not face these facts.

4. FIRE: Deals with pollution by radioactivity, not only used for weapons, but also for industry. Waste is stored in vast quantities and can leak out if there is an earthquake or explosion. A serious and challenging film on a subject of the most vital importance. A Thames TV production, 1970.

Colour 60 mins. NSW £7·00

The Battle for Urban Mobility

This film is about America's love affair with the car. It's also a film about America's disenchantment with the idea of public transport. And yet that is the choice; automobiles that will kill the cities, slowly, yet surely, or systems of public transport that will save them. Vested interests with a stake in the car industry try to delay this. Westinghouse Broadcasting Co., U.S.A.

Colour 50 mins. £7.00

Boomsville

Cartoon tracing the growth of a typical city, from a tiny settlement in the North American wilderness to the car-clogged metropolis that so many cities are today. National Film Board of Canada 1968.

Colour 10 mins. £2.00

Bronchitis

Bronchitis is called the English disease, partly because of our climate. Three factors cause it: polluted air, working conditions (such as mining) and smoking. The last is up to the individual: the connection is definitely proved. But are we doing enough about clean air? Many of our cities have no smoke restrictions, and even when such restrictions exist, nothing can be done about poisonous fumes which cannot be seen. Bronchitis is a very distressing illness, which causes a very high number of deaths each year compared with other diseases. Could more be done to prevent it? Granada "World in Action" Programme. 1965.

B/W 25 mins. £3.00

The City

A series of films by the National Film Board of Canada, filmed in 11 countries under the title "Lewis Mumford on the City". 1963.

B/W Each part 28 mins. Each £3.00
(Each part is complete in itself).

Part I. **The City—Heaven and Hell**
The opposed natures—creative and destructive—of the city in history, the elements that created the first cities, and the forces that now threaten to destroy "man's most precious collective invention".

Part II. **The City—Cars or People?**
An old but dangerously growing problem—how to make the city accessible for meeting and mixing without allowing transportation to make it congested and uninhabitable, as the motor car threatens to do.

Part III. **The City and its Region**
History shows that cities thrive best when they live in harmony and balance with the countryside around them. How can this balance be maintained or restored in today's sprawling metropolitan regions?

Part IV. **The Heart of the City**
A study of the growing sterility, dullness and congestion that is destroying the vitality, variety and breadth that once made cities physically attractive and humanly creative.

Part V. **The City as Man's Home**
Slums, giant public housing complexes, mass suburbs, anonymous and bleak luxury apartments — almost everywhere in our cities communal standards of living are falling as personal standards rise. How did this happen and what can our cities do to improve communal living standards?

Part VI. **The City and the Future**
In more and more regions of the world the inevitable and urgent choice must be made—low-grade urban sprawl or a new kind of regional city. Prospects and ways to restore its rôle as the focus of man's highest achievement.

City Limits
What are the factors that make a city a pleasant place to live and work in, with its own character and life? Jane Jacobs examines the trends that are killing cities now, particularly the private car, mainly in North America, but we have lessons to learn here before it is too late. 1972.
Colour 30 mins. £4.40

Conservation and Balance in Nature
A comprehensive picture of man's relationship to his environment, and the inter-relationship of the living things themselves. Examples of various environments and different kinds of living things are shown, and also the use of pesticides and chemicals, and the film ends by stressing man's responsibility to use wisely his natural environment.
Colour 18 mins. £3.00

Dead Earth
Links the survival of our environment with those of corporate responsibility. Cites the use of ecology destroying defoliants in South East Asia and elsewhere. Commentary by the noted ecologist Barry Commoner. Starts with a witty and explicit cartoon. 1971.
Colour 20 mins. £3.00

Don't Spoil Our World (Filmstrip)
A colour filmstrip of paintings by schoolchildren in Ipswich about pollution—how it affects their lives, and all life. Includes a poem. 1973.
Colour 35 frames with text
Sale only: £3.00

The Drag
Amusing and fast-moving cartoon about smoking, suitable for all audiences, including schools (and also film societies). A subtle knock at the cigarette advertisers, and those who believe the advertisements. National Film Board of Canada. 1967.
Colour 9 mins. £2.00

Element Three
The water supplies of the world cannot for long continue to slake the thirst of the land and of men unless in the near future hydrological work of considerable scope and variety is carried out. By means of a poetic quality that is sometimes tragic, as well as through the information it provides, this film demonstrates the complexity and urgency of the problem. Produced by the National Film Board of Canada in co-operation with U.N.E.S.C.O. "A wonderful and beautiful film. Engenders responsibility in community—encourages careful use socially and industrially".—U.N.A. Branch. 1965.
Colour 45 mins. £4.00

THE ENERGY SERIES

Energy: The Dilemma
Energy growth patterns, past, present and future. Explores problems of supply and demand, depletion of fossil fuels, our dependency. Will we run out of fuel soon? Will we ruin our environment in the process? Is the age of the car nearly over? U.S.A. 1974.
Colour 20 mins. £3.60

Energy: The Nuclear Alternative
Explores what fission power is, how it works and the safety of nuclear power stations. Can we afford to take this risk, and can we afford not to? U.S.A. 1974.
Colour 20 mins. £3.60

Energy: New Sources
There are better ways of obtaining power: solar panels, hot water geysers under the earth, harnessing the tides, fusion power. Introduces new research.
Colour 20 mins. £3.60

Energy: Less is More
What of the future? Can we cut down on our use of energy? Will this only put off the evil day; will we have to adopt a new way of thinking altogether? U.S.A. 1974.
Colour 18 mins. £3.60

Environment
The degrading of our environment is a major problem. However, the causes of this deterioration are complex and are closely bound to the strengths of a modern individual society: affluence, advanced technology and individualisation. This film probes beyond superficial rhetoric and shows that while such practices as high technology farming can be destructive to the land, the products of this farming are vitally needed. What balances must be struck? Can we preserve our environment and still hold on to our technology and life style? After posing these questions, this unusual and highly dramatic film is left open-ended. U.S.A. 1974.
Colour 28 mins. £3.60

In a Cleaner, Greener Land
The Facts Are These
A series for 15 year olds and over, approved by the Educational Advisory Council for I.T.A., and made by the Schools Department of Granada Television, 1973.
Starts with the industrial revolution, relating it to later pollution of air, water and land. The effects of smoke, effluent in rivers, and litter on the ground are shown, and some efforts by groups of people to combat them, such as direct action by young people in taking back non-returnable soft drink bottles to the manufacturers.
Colour 20 mins. £3.00

First Mile Up
Air pollution. An examination of the problem, with explanations of its causes and dangers, and comments by experts, including Dr. Linus Pauling. National Film Board of Canada. 1961.
B/W 30 mins. £3.00

For Your Pleasure
A really delightful cartoon by Derek Phillips, on the growth of motorways and tall buildings. The advance of the concrete jungle on the beauty of the Suffolk countryside in Constable's famous landscapes. A humorous cartoon with serious undertones. 1970.
Colour 5 mins. £1.60

A Funny Thing Happened on the Way to the Garbage Dump
The problems of sewage and waste disposal, and some positive ideas for overcoming them, for instance in Paris where the refuse is burnt in furnaces which provide parts of the city with hot water. The importance of salvaging metals, and other ways of using waste are shown. The technology exists to conquer waste and pollution, but at what price? BBC TV. 1970.
B/W 51 mins. £4.40

I Tried Cotton Wool, but it Made My Ears Go Funny
Do most of us really know the price that is being paid by people who live near the new great motorways and their junctions, for this "progress"? This film examines the impact of "Spaghetti Junction" (Gravelly Hill intersection at Birmingham), on the inhabitants of that area. Made by John Morris, 1973.
Colour 30 mins. £4.40

Keepers of the Wilderness

So many wild animals are in danger of extinction that scientists have to learn more about their habits to try to preserve them. Bears are branded, and have transmitters fixed to them so their movements can be traced, and birds are caught and ringed. Is there soon to be no place for animals in the world, if they don't directly serve man? National Film Board of Canada, 1972.

Colour 30 mins. £4.40

King Size

It is aimed at youngsters—but every adult, smoker or not, will benefit from this advice to stay away from tobacco. This is an animation film, and so anything can happen, and does, including a visit to the kingdom of King Size where no smoking is forbidden. Assaulted on all sides by cigarettes or cigarette smoke, our young hero soon has had enough. Home once more, he is ready to do his bit against the menace. What he does is as amusing as the rest. National Film Board of Canada. 1968.

Colour 7 mins. £1.60

Let's Discuss Smoking

A straightforward discussion on the likely effects of smoking, in which a group of teenagers question Dr. F. R. Wake, of Carleton University (Canada). Many aspects are mentioned, among them the problem of parents who smoke! National Film Board of Canada. 1964.

B/W 16 mins. £2.00

Limits of Growth

The problem of our world points to disaster in the future. A group of influential academic and businessmen get together, with the help of a computer, to analyse the problems and find some solutions. It appears that all the issues (violence, pollution, starvation, population growth) are interlinked, and it would be of no use to attack just one aspect. A powerful and stimulating film by Richard Broad, who made "And on the Eighth Day", which shows the urgency with which we need to do something, and could help everyone to see more clearly the direction in which we should work to avert world chaos. Thames TV. 1972.

Colour 60 mins. £7.00

Little Man, Big City

A cartoon which dramatises the plight of today's city dweller. The "little man', lives in a typical urban centre where poor planning, haphazard design and inadequate health controls have depleted him emotionally and physically. Beseiged by overcrowding, noise, pollution, lack of privacy and open spaces, and the hectic and uniform pace of living, even in the confines of his small apartment, he cannot escape the noxious effects of his surroundings. Made by Hungarian Film Studios for the World Health Organisation.

Colour 10 mins. £2.00

London, Unique City

Where other cities have grown upwards, London has ever increasingly edged her boundaries outwards into the Home Counties. This has been partly due to the denizen's desire to combine housing with areas of greenery. What methods can be used to solve the problem of London's sprawl?

B/W 30 mins. £3.00

A Matter of Attitudes

Pollution in Canada. A project to discover how much people are aware of pollution, and what they feel should be done about it. What is pollution? How does it affect this country? Who should be responsible for doing something about it? Useful for starting an enquiry into pollution. National Film Board of Canada. 1968.

B/W and Colour 30 mins. £3.00

Multiply and Subdue the Earth

Deals in considerable detail with man's misuse of his environment. Examples are shown of how man has failed to work in harmony with his surroundings, and the resulting pollution and environmental disaster. Useful not only for ecology but also General Studies and "A" level work on the geography of the United States. An excellent film in all respects. Pro duced by National Educational Television, USA. 1970.

Colour 50 mins. £7.00

The Pavement (Bruk)

Polish cartoon about a man who is covering the whole world with paving stones. He finally comes to the last tree, and realises too late what he has done. Shown at Overhausen. 1972.

Colour 10 mins. £2.00

Persistent and Finagling

The true story of a pressure group (Stop: Society to Overcome Pollution) in Montreal. They are mostly women, who plan a project, and feel they need the support of a big-name personality only to wonder if this was a good idea when he agrees. (Persistent and finagling are his epithets for them.) As much an examination of the members of the group as their actions. National Film Board of Canada. 1971.

B/W 60 mins. £4.00

Poisons, Pests and People

The effects of widespread use of chemical insecticides, shown and discussed by experts. We have come to depend on these—perhaps too much, as Rachel Carson's 'Silent Spring' pointed out—but life might be impossible now without them. Some experiments with new techniques are shown. National Film Board of Canada film. 1960.

B/W 60 mins. £4.40

POLLUTION SERIES

The First Pollution

This information survey of water quality management and improvement techniques examines the use of both classical and new methods of waste water treatment in various industries and towns in America. Both ways are designed to remove oil, acid and organic chemicals and so produce water that can be recycled and used for a variety of purposes. Other new techniques explained include the use of computers, using sludge as a resource and using microbes in the reclamation process. This film effectively demonstrates that water quality standards can be set and enforced and urges the public to act. 1966.

Colour 26 mins. £3.90

The Second Pollution

The pollution that affects us most personally is the pollution of the air we must breathe. Los Angeles provides a case history of a city that has worked for decades to reduce the air pollution from both stationary and mobile sources, and yet still has a serious problem today. Chicago is using new laws and strict enforcement to control sulphur oxide emissions produced in the burning of fossil fuels. Automobiles spit out hydrocarbons, carbon monoxide and nitrogen oxides, and current efforts are primarily focused on catalytic conversion to more acceptable materials and redesign of the internal combustion engine. 1966.

Colour 22 mins. £3.80

The Third Pollution

Improved methods for handling 150 million tons of solid waste disposed of each year in the U.S.A. are explained, and examples given of a sanitary landfill in Los Angeles and an incineration plant in New York that not only burns 750 tons of water per day without causing air pollution, but has a waste heat recovery unit that generates power and converts salt water to fresh water. The problem of the disposal of livestock waste are

also raised, and of the recycling and salvage of scrap metal, particularly cars, and new ways in which waste solids can be converted into gas and charcoal explained. U.S.A. 1966.
Colour 23 mins. £3.80

Population and Pollution
Short film linking these two vital subjects, and pointing out some ways in which the natural environment can be appreciated. Suitable for older school children upwards. U.S.A. 1970.
Colour 18 mins. £3.00

Recycling
A filmed survey of some attempts to dig the U.S.A. out from under its own refuse. Skilfully proves that almost every form of solid wastes, from newspapers to spoiled peaches, could be rescued from mounting scrap heaps and turned into a high quality product. U.S.A. 1971.
Colour 21 mins. £3.20

River With a Problem
Water pollution. The Ottawa River is an example of what happens when a river is used as a dumping ground for city and industrial waste. Animation illustrates exactly what happens to water as it becomes polluted. Engineers, health authorities and civic officials voice concern over this increasingly urgent problem. National Film Board of Canada. 1961.
B/W 28 mins. £3.00

Smoking and Health—A Report to Youth
Is smoking worth the risk? How the trachea, bronchi and lungs work, and how they are affected by smoking, are shown by animation sequences, and the evidence about bronchitis, emphysema and lung cancer and their proved connection with smoking is set out, especially as these affect young people.
Colour 13 mins. £2.20

Smoking—It's Your Choice
A factual film showing the actual harm smoking can do—emphysema, cancer of the lungs or larynx, heart trouble, etc, yet young people continue to smoke—why? Some of the answers are given: the others all do; to look grown up. An open-ended film to start discussion. U.S.A. 1971.
Colour 15 mins. £2.60

The Stripping of Appalachia
Strip coal mining is being carried on in the Appalachian area of America on a large scale, with no consideration for human or animal inhabitants. A British company is largely responsible. Granada "World in Action" programme. 1972.
Colour 30 mins. £4.40

That's the Price
Pollution and prosperity often go hand in hand, and this film is a sensitive record of what happened when a multi-million company came to a derelict mining area in British Columbia to operate open cast mining on a scale never before attempted anywhere. The effect on the topography of this very beautiful area, and more particularly on the people who lived near and had to move are tellingly shown. One old man, who had been squatting illegally, surveys the ruins of his home after it had been bulldozed by the company. Objectively, one knows he should not have been there, but seeing his anger, frustration and utter bewilderment, one knows this sort of thing ought not to be done to a person. Prosperity was brought back to the neighbourhood, but was the price of it too high? National Film Board of Canada. 1971.
Colour 40 mins. £6.40

Where There's Smoke
A number of amusing cartoon spots making the point that smoking is harmful and stupid. Suitable for children especially. National Film Board of Canada. 1972.
Colour 14 mins. £2.60

Who Stole the Quiet Day?
Noise—what effect does it have on us? We are increasingly exposed to high noise levels, which we cannot shut out as we can light with our eyes. Shows how the ears work, and how hearing loss occurs, and the other health problems caused by loud noise. Is there anything we can do to improve the situation? Suitable for most age groups. U.S.A. 1973.
Colour 16 mins. £2.60

The above films are all 16mm and available from:
Concord Films Council Ltd.
Nacton
Ipswich
Suffolk IP10 0JZ
Tel: Ipswich (0473) 76012

ELECTRICITY COUNCIL FILM LIBRARY

A Breath of Spring
A film showing how air conditioning can improve internal environments in offices, shops and restaurants.
Colour/sound 18 mins. 16mm
Ref. No. 151 3820-7

Building a Climate
A film for the construction industry which tells the story of the design and building of the first integrated design building to be constructed in a temperate climate using a single energy source.
Colour sound 25 mins. 16mm
Ref. No. 151 3816-3

Living with Electricity
A film about electrical safety in the home.
Colour 35mm Purchase only £1.50
Ref. No. ECFS1
Accompanying booklet: A5 size, 16 pages with colour illustrations. £5 for minimum of 75 copies.

Make Room with Electricity
A film about home improvement and general improvement areas. Shows how electricity can improve old homes.
Colour 24 mins. 16mm
Ref. No. 151 3812-8

The above films are available from:
The Electricity Council Film Fibrary
Trafalgar Buildings
1 Charing Cross
London SW1A 2DS

FIELD STUDIES COUNCIL

The Hidden World
Shows work in progress at the nine field centres and emphasises the delicate balance of Nature. Secondary school upwards.
Colour 19½ mins. 16mm
Available from The Secretary
Field Studies Council
9 Devereux Court
Strand
London WC2
Tel: 01-583 7471

GATEWAY EDUCATIONAL MEDIA

Biological Equilibrium
Whenever man interferes with the long established order of Nature, unintentionally or deliberately, he starts a long chain of changes.
Colour/sound 16mm 12 mins. £3.30

Of Broccoli and Pelicans and Celery and Seals
Pesticides used in agriculture are shown to be carried by the natural land drainage into rivers, and finally to the sea. Contaminated fish are eaten by birds, animals and men. DDT derivatives are toxic, stable for up to 20 years and they accumulate in the fatty tissues of all living things.
Colour/sound 16mm 29 mins. £4.70

The above films are available from:
Gateway Educational Media
St. Lawrence House
29/31 Broad Street
Bristol BS1 2HF
Tel: 0272 25351

GUILD SOUND & VISION LTD.

The Coal Gatherers 171 2913-2
Production, restoration and conservation are seen working together in this film showing the process of mining by opencast methods at Radar North, Widdrington, Northumberland, one of Britain's biggest operations of its kind. The whole operation of coal extraction is programmed in a series of 100ft wide 'cuts', the waste from each being dropped into the void made by its predecessor. But always the good soil is set aside. Already 900 acres—almost half the total site—have been brought back to agricultural use. On land from which the coal has been won, corn is now harvested, cattle graze and trees grow.
Derek Crouch (Contractors) Ltd.
Colour 22 mins.

A Load of Old Rubbish 300 7368-4
It is the job of the London Borough Councils and the Greater London Council to get refuse safely away from London's streets and homes and dispose of it to the best advantage, salvaging and recycling where possible, and at all times protecting our environment and improving it by creating new land out of our load of old rubbish.
This film takes a lively look at London's refuse disposal, past and present, and traces the history from the days when rubbish was thrown from the windows ('gardez loo') and describes today's sophisticated methods.
Note: This film is available on free loan to Local Governments and schools who should apply direct to the Public Information Branch, Greater London Council, The County Hall, London SE1.
Greater London Council.
Colour 26 mins. £2.80 + VAT

Protection of Nature:
Report from Sweden 300 3965-3
This is the English version of K. H. Scheibenflug's film "Umwelt Probleme-Schwedish Gelost" and shows how the current environmental problems, such as water purification, are being overcome.
The Swedish Institute.
Colour 30 mins. £2.50 + VAT

Something Can be Done about Water 185 2603-3
Everywhere the population is increasing, especially in the industrial areas and along the big rivers, and the disposal of waste is a major problem. Life is impossible without water and our rivers are suffocating and dying. Although there is no complete cure for this complicated problem, one remedy is flocculation agents, which accelerate the deposition of solids and facilitate for dehydration of sludge. This film shows the use of Sedipur for the treatment of industrial waste water and municipal sewage.
17 mins. Not available to schools

Trash to Treasure 233 7330-2
This film deals with the need for efficient, special-purpose machines performing recommended steps in the most modern method for practical refuse disposal. The benefits of this method are depicted through the conversion of normal urban waste lands into such useful developments as parks, recreation areas, airports, playgrounds etc.
International Harvester Co. of Great Britain Ltd.
Colour 18 mins.

The above films are available from:
Guild Sound & Vision Ltd.
Woodston House
Oundle Road
Peterborough PE2 9PZ
Tel: Peterborough (0733) 63122

HODGKINSON BENNIS LTD.

The Properties of Coal
Shows how the properties of coal vary according to the areas where it is mined, and how these characteristics affect its behaviour during combustion. The film gives an explanation of swelling number and shows how various types of coal suit different types of stokers.
Colour 20 mins. 16mm £3.00

Available from:
Hodgkinson Bennis Ltd.
Little Hulton
Worsley
Manchester M28 6SS
Tel: 061-790 4411/9

ICI FILM LIBRARY

The Choice
The film's main themes are earth, fire and water. It concentrates on what is being done and what can be done, to preserve the environment. Science and technology have already provided most of the answers. Co-operation between industry and the community has already demonstrated that it can yield worthwhile results. Future success will depend on continuing investment, and, above all, a wider, more vigorous co-operation.
Colour/sound 29 mins. 16mm

Something to Sing About
The problem of aerial pollution tackled by ICI's Agricultural Division at Billingham on Teesside. The achievement of a 98 per cent reduction of sulphur dioxide, grit and dust.
Colour/sound 12 mins. 16mm

The above films are available from:
ICI Film Library
Thames House North
Millbank
London SW1
Tel: 01-834 4444

LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY

Air Pollution

1. Sources & Effects
The sources of the five contaminants responsible either singly or in combination for most air pollution are detailed, and their effects on people and the environment examined (Sulphur dioxides, carbon monoxide, nitrogen oxides, hydrocarbons and lead). Overall the film puts pollution in historical perspective and shows what information is required and what action needs to be taken continually to improve the situation.
Colour/sound Approx. 25 mins. 16mm

2. The Science of the Situation
The nature and behaviour of particles in air is examined since it is the principles behind the physical laws governing this behaviour which are used to design gas-cleaning apparatus. Scientific and technical; suitable for VI forms, industry and Local Government personnel.
Colour/sound 25 mins. 16mm

3. Methods of Control
This film examines how intelligent legislation concerning air pollution must avoid serious economic damage to industry or the community, yet recognise the need for control. Methods of control examined are process modifications, pollutant removal and pollutant dispersion. Meteorological factors are illustrated and the special interest of vehicle pollution is acknowledged and methods of tackling the problem are discussed.
Colour/sound 25 mins. 16mm
Charge per film: £12 for two days. Half price for Further Educational establishments. £2.50 for schools.

Available from:
Centre for Extension Studies
Loughborough University of Technology
Loughborough
Leics LE11 3TU

MOTHERWELL BRIDGE TACOL LTD.

No Tipping
Illustrates the "System Dusseldorf" approach to refuse disposal and shows the threat to clean air posed by traditional methods of refuse disposal.
Colour 14 mins. 16mm

Available from:
Motherwell Bridge Tacol Ltd.
Green Dragon House
64-70 High Street
Croydon
Surrey CRO 1NA
Tel: 01-686 6917

NATIONAL AUDIO-VISUAL AIDS LIBRARY

The following films are produced by Encyclopaedia Britannica.

Controversy over Industrial Pollution—A Case Study 1974 Secondary
Colour/sound 17 mins. 16mm

The Earth: Man's Home 1970
Infant and Primary.
Colour/sound 10 mins. 16mm

The Everglades—Conserving a Balanced Community 1968
Colour/sound 11 mins. 16mm

The Garbage Explosion 1970
Colour 16 mins. 16mm

House of Man—Our Crowded Environment 1968
Colour/sound 11 mins. 16mm

The Living Environment 1962
Suitable as introduction to ecology.
Colour/sound 8 mins. 16mm

Noise—Polluting the Environment 1971
Colour/sound 15 mins. 16mm

The Population Problem 1964
Colour/sound 13 mins. 16mm

Problems of Conservation—Air 1968
Colour/sound 15 mins. 16mm

Problems of Conservation—Forest and Range 1969
Colour/sound 14 mins. 16mm

Problems of Conservation—Minerals 1969
Colour/sound 16 mins. 16mm

Problems of Conservation — Our Natural Resources 1970
Colour/sound 11 mins. 16mm

Problems of Conservation—Soil 1969
Colour/sound 14 mins. 16mm

Problems of Conservation — Water 1969
Colour/sound 16 mins. 16mm

Problems of Conservation—Wildlife 1970
Colour/sound 13 mins. 16mm

Trees and their Importance 1966
Infant and Primary.
Colour/sound 11 mins. 16mm

The above films are available for hire (charges on request) from:

National Audio-Visual Aids Library
Paxton Place
Gipsy Road
London SE27
Tel: 01-670 4247

N.C.B. FILM LIBRARY

For General Audiences:

Billingham Group Heating Scheme
A solid fuel group heating scheme serving mixed industrial, commercial and residential premises in a new town extension at Billingham, Co. Durham. 1965.
Colour/sound 14 mins. 16mm

Clean Air at Handsworth
This film, a section of 'Welcome Home', describes what happens when a new smoke controlled area is created, and what the householder has to do. It shows three conversions to different types of smokeless solid fuel appliances, quoting the costs, the Local Authority grants, and also, in one case, the National Coal Board's Housewarming Plan. 1967/72.
Colour/sound 8 mins. 16mm

District Heating
A report on the domestic and international developments in heating buildings from a central boiler house. Contributions in the argument are made by economist E. F. Schumacher, heating engineer Ernest Haseler, and expert on hypothermia, Dr. Geoffrey Taylor. 1972.
Colour/sound 24 mins. 16mm

Home and Warm
The film deals with the modernisation of an older type house and the installation of modern solid fuel central heating. 1967.
Colour/sound 10 mins. 16mm

Incinerate—With Coal
Nottingham Corporation incinerate the city's rubbish to fuel the biggest district heating scheme in this country. Coupled with a coal-fired heat station, the scheme heats redevelopments in the city centre, several housing areas and existing buildings. 1973.
Colour/sound 26 mins. 16mm

The Modern Mine
An impression of the way the mine of the future will be run using remote control techniques, television monitoring devices and a central control panel. This film has been developed from a motion picture presentation devised for the 1965 C.U.M.M. Exhibition. 1966.
Colour/sound 14 mins. 16mm

Restoration of Land After Opencast Coal Mining
The film provides a practical example of how land is restored to agricultural use after opencast mining—conservation in action. 1973.
Colour/sound 19 mins. 16mm

The Smoke Eater
A young woman faced with a Smoke Control Order finds, after investigation, that a Smoke Eater is cheap and easy to run, never goes out, and is smokeless. 1973.
Colour/sound 6 mins. 16mm

Tomorrow's Coal
Austin Mitchell, television presenter, examines the prospects of the projected Selby coalfield, and explores the attitudes towards it of some of the people of the Plain of York. Expert opinion is enlisted to resolve the problems which lie ahead, and the chairman of the Board sums up. 1974.
Colour/sound 27 mins. 16mm

Welcome Home
Demonstrates the modern equipment available for burning solid smokeless fuels, and the range of these fuels available. The film also describes the Clean Air Act, how it works, and how solid fuel meets its requirements. (The Solid Smokeless Fuel Federation publication 'Clean Air is for You' is recommended for distribution to audiences of the film). 1968.
Colour/sound 22 mins. 16mm

"Review"

27REV3 No. 3 (twenty-seventh year)
Warmth From Waste
Heat from the burning of refuse helps coal to warm Nottingham shops, offices and houses. 1974.
Colour/sound 10 mins. 16mm

27REV7 No. 7 (twenty-seventh year)
Full Cycle
With the present shortage of fuel the bicycle comes into its own—as a humane machine, efficient and adaptable alike for work and pleasure. 1974.
Colour/sound 10 mins. 16mm

27REV12 No. 12 (twenty-seventh year)
Today and Tomorrow
Britain's coal industry is expanding, to meet the demands of the 80's and after, to forestall a drastic energy famine. New collieries, as well as reconstructed existing pits, can boost output to 150 million tons a year. 1974.
Colour/sound 10 mins. 16mm

NCB Technical Instruction Films

Airborne Dust Sampling
Describes the importance of regular sampling in dust suppression and demonstrates the principles and operation of the Type 113A gravimetric sampler. 1971.
B/W 20 mins. 16mm

Dust Sampling in Roadways
Explains the vital importance of regular sampling of dust, and demonstrates the techniques employed in both strip and spot sampling. A particular sequence of the film deals with sampling in wet and muddy roadways. 1971.
B/W 24 mins. 16mm

Introduction to Dust Hazards
A film for indoctrination courses to demonstrate the various medical degrees of pneumoconiosis and to delineate the means available of combating the disease. 1973.
Colour 15 mins. 16mm

A Mine Fights Dust
Men and management set about improving conditions by all-round consultation and action. 1971.
B/W 23 mins. 16mm

What's the Answer to Dust?
Trilogy of films designed for management and men. Introduced and narrated by William Woollard.
Part 1: Minimise it.
The emphasis is on correct cutting and loading procedures. 9 mins.
Part 2: Use water—in the right place. 7 mins.
Part 3: Extract it.
An exposition of the importance of correct ventilation practice in the control of dust. 5 mins. 1974.
B/W sound 16mm

The above films are available from:
The National Coal Board Film Unit
Hobart House
Grosvenor Place
London SW1X 7AE
Tel: 01-235 2020

NATIONAL SOCIETY FOR CLEAN AIR

Horsepower and Hydrocarbons
The California Motor Vehicle Control Board explain the nature and extent of emission problems from the motor car. The alternatives to the petrol driven car are examined, as are methods of reducing levels of emission. The first film to approach all aspects of the problem fully.
Colour 22 mins. 16mm

Available from:
National Society for Clean Air
136 North Street
Brighton BN1 1RG
Sussex
Tel: Brighton (0273) 26313

RANK AUDIO-VISUAL LTD.

Deterioration of Water
Displays various pollutants. 13+.
Colour 19 mins. 16mm £3.50

The Empty Nest
Threat of extinction by pesticides menaces the Osprey.
Colour 20 mins. 16mm £3.50

Man's Impact on the Environment
35-frame colour filmstrip £2.50

Noise Pollution (13+)
Colour 18 mins. 16mm £3.50

The above films are available from:
Rank Audio-Visual Ltd.
P.O. Box 70
Great West Road
Brentford
Middlesex

SHEFFIELD PUBLICITY OFFICE

Clean Air City
A film on Sheffield's victory over smoke.
The 25-minute documentary explains the City's vigorous application of the Clean Air Act, making Sheffield the first major industrial city in Britain to be covered throughout by smoke control regulations.
Entitled "Clean Air City", the film includes shots of the dirty pre-war Sheffield, and illustrates how, since 1959, the City has progressed steadily to a situation in which every building—every house, every factory—is banned by law from emitting smoke. In addition to explaining the Corporation's 13-year clean air programme, the film includes interviews with civic and industrial leaders, and members of the general public, to illustrate the thinking behind and the results of air pollution control—better health, improved plant life, less industrial absenteeism, and a higher quality of life.
Colour 25 mins.

Available from:
Sheffield Publicity Office
Yorkshire Bank Chambers
Surrey Street
Sheffield S1 1LP
Tel: (0742) 734067

SHELL FILM LIBRARY

Deep Sea Endeavour
Looks at the problems posed by the search for oil offshore and explains many of the techniques for the shallow waters of the Continental Shelf and in deeper, rougher waters beyond the capacity of the jack-ups. Semi-submersible drilling platforms and the drill ship Seco 445 are featured. 1973.
Colour 26 mins. 16mm

Environment in the Balance
The film shows how geological, topographical and social developments in Britain have helped to shape our environment and discusses the problems of industrial expansion, population growth and pollution. Given the technological ability to safeguard the future, the issues depend on us all, as individuals. 1970.
Colour 30 mins. 16mm

Fuel for the Seventies
A film describing the increasing uses of liquefied petroleum gases in industry and the service provided by Shell-Mex Ltd. 1970.
Colour 14 mins. 16mm

Land Reclamation
Every year nature encroaches on valuable farm land. Every year farmers fight back. This film shows how modern techniques can be used to reclaim flooded land, bracken-covered areas, and land covered with tussocks and woods. 1959.
Colour 25 mins. 16mm

Oil on Top
Made in association with the British Advisory Committee on Oil Pollution of the Sea, the film describes how tankers using the 'load on top' system can minimise marine pollution. The oil is separated from the water and retained on board in a storage tank while the water is discharged. 1967.
Colour 14 mins. 16mm

The River Must Live
River pollution and how it can be overcome by the treatment of urban and industrial wastes. Filmed on the Continent. An unpleasant subject treated sympathetically and practically with splendid photography. 1966.
Colour 21 mins. 16mm

The above films are available from:
Shell Film Library
25 The Burroughs
Hendon
London NW4 4AT
Tel: 01-202 7803

UNIVERSITY OF SALFORD

Dust Sampling in Ducts and Chimneys
This film is based on two articles published in the magazine *Environmental Health* for January 1971 by Dr D. F. Ball and Mr D. L. Griffiths of Salford University.
The film describes the theory and illustrates the practice of dust sampling, showing both the conventional method and the B.C.U.R.A. cyclone method. It is intended for people who have no previous experience of these techniques.
B/W 52 mins. 16mm optical sound track £10.00

Available from:
Audiovisual Media Unit
University of Salford
Salford
Lancs M5 4WT
Tel: 061-736 5843

GENERAL AUDIO-VISUAL TEACHING AIDS (SLIDES, CASSETTES ETC.) ON ENVIRONMENTAL SUBJECTS

AEROFILMS LTD., Elstree Way, Boreham Wood, Herts. Tel: 01-953 6161.

"Extraction, Conservation and Pollution". Set of 24 aerial photographs taken of different areas in Britain, e.g. air and sea pollution by coastal industrial plant, Workington, Cumberland. Available as 9in × 7in B/W prints, £3.30 set; overhead projector transparencies, £9.35 set; 35mm slides, £3.30 set.

ARCHITECTURAL PRESS LTD., 9 Queen Anne's Gate, London SW1H 9BY. Tel: 01-930 0611.

Lifescape 1: The Way Things Are. £1.50 (10 or more, £1.20 each). Teacher's handbook 25p.

Lifescape 2: Home, Neighbourhood and Community. £1.75 (10 or more, £1.50 each). Teacher's handbook 30p. A series of loose-leaf folders examining the environment we live in, what factors have produced it and where we are heading. Each folder contains 80-100 pages, with many large-sized photographs. Press cuttings and quotations emphasise points; questions and suggestions for discussion and project work are made.

CAMERA TALKS LTD., 31 North Row, London W1R 2EN. Tel: 01-493 2761.

"Air Pollution". Black and white.

"Clean Air". Parts 1 and 2.

"Pollution". Colour.

"The Problem of Lung Cancer". Colour.

"The Public Health Inspector". Colour.

Available as filmstrips, £3.95 each. Boxed slide sets, £5.95 each. Slide sets in albums, £7.50 each. Teaching notes, 50p per set. Cassette or spooled tapes to accompany them, approx. £4 each.

DIANA WYLLIE LTD., 3 Park Road, Baker Street, London NW1. Tel: 01-723 7333/3330.

"Air Pollution"—in two parts.

"The Air You Breathe". Lecture notes by Rear Admiral P. G. Sharp.

"Chronic Bronchitis". Section 1: Incidence and Causes. Section 2: Treatments and Management. Section 3: Public Health and the Prevention of Chronic Bronchitis. Lecture notes by Dr. J. L. Burn. Double frame only.

"Environment: Air Pollution, Parts 1 and 2". 1: Local Continental and Natural. 41 frames. 2: Industrial Pollution. 38 frames. Lecture notes by Prof. R. S. Scorer.

"Environment: Energy". Part 1: Resources and Use. 41 frames. Part 2: Conservation. 39 frames. Lecture notes by Rear Admiral P. G. Sharp and H. Brown, Energy Resources Consultant. Cassette commentary £3.00.

"Environment: Waste and Recycling". Cassette commentary £3.

"Man-Made World"—in four parts.

"Nature Conservation in the British Isles"—in two parts.

"Population and Resources"—in two parts. Cassette commentary £3.

"Water Pollution"—in two parts.

A series of colour filmstrip/slide sets with lecture notes for schools and upwards. Each part of the series is priced at £3 single frame and £3.50 double frame.

EDUCATIONAL PRODUCTIONS LTD., Bradford Road, East Ardsley, Wakefield, Yorks. Tel: (0924) 823971.

"Air Pollution". A study folder containing six work cards, six study prints and data sheet. Produced in collaboration with Gas Council. Price 75p.

"Caring for our Countryside". A series of filmstrips investigating man's impact on the countryside. The series includes:

"How Natural is our Countryside?"

"Man's Impact on the Countryside Environment".

"Man and the Countryside—Conservation and Reclamation".

Available in single frame £2.50 each; double frame £3.40 each.

GATEWAY PRODUCTIONS LTD., St. Lawrence House, 29/31 Broad Street, Bristol. Tel: (0272) 25351.

"Discovering Our Environment". Four study print sets. Each set includes 10 photographs and teacher's guide, a study guide and a 'survival game'. 6+. Price: £30.60.

"Ecological Communities". Six filmstrips and six cassettes. 8+. Price: £36.70.

"Learning About Conservation". Price: £34.80.

"Pollution". Six single-frame filmstrips and six cassettes. 11+. Price: £38.40.

"Treeman—a First Adventure in Ecology". Complete set of 18 study prints, filmstrips and cassette. 6+. Price: £21.50.

JOHN PARRY, Grenville Lodge, Henley-on-Thames, Oxon.

"Our Spaceship Earth". An unscripted lecture by John Parry, illustrated by colour slides and a rôle-playing game. Age range: primary and secondary. Fee: £20 per visit, plus expenses (Slides not available for hire separately).

MACMILLAN EDUCATIONAL, Houndmills, Basingstoke, Hants. Tel: Basingstoke 29242.

"Conservation". A complete kit providing one term's work for up to 50 pupils 14-16 years. Contents: teacher's book, 24 work sheets (50 copies of each), four information sheets (30 copies of each), filmstrips on water sources, water pollution, air pollution. Price: £18.50.

PICTORIAL CHARTS EDUCATIONAL TRUST, 27 Kirchen Road, London W13 0UD. Tel: 01-567 9206.

Wallcharts and photopacks.

"Energy". Photo discussion pack on conventional and alternative energy resources. £1.25 + VAT.

"The Motor Car". Photo discussion pack illustrating the impact of the motor car on our environment. £1.25 + VAT.

"Pollution". Ten large photographs with notes. £1.25 + VAT.

"Respiration". 30in × 40in chart shows the organs of external and the processes of internal respiration. Pictures make the point of air pollution and refer to lung cancer. With chart notes. £1.00 + VAT.

"Transport". Ten large photographs deal with some of the problems arising from the increasing volume of transport and look at some attempted solutions. £1.25 + VAT.

THE SLIDE CENTRE, Portman House, 17 Brodrick Road, London SW17. Tel: 01-672 3221.

A series on the pollution of the environment.

"Pollution—Introduction and Historic Background". Slide folio of 18 slides, £2.60.

"Pollution—Ponds and Rivers".

"Pollution of the Air".

"Pollution—Us Versus the Rest—Extinction".

"Pollution of the Sea".

"Pollution by Waste".

Each of the above slide folios contains 12 slides and costs £1.95 per set.

Recent Acquisitions to the NSCA Library

All available on loan to members

Advances in Environmental Science and Technology. Eds. Pills and Metcalf. John Wiley & Sons. 1974. Vol. 3, 386 pages, Vol. 4. 382 pages. £10.60 each.

Air Pollution. D. J. Spedding. Oxford Chemistry Series No. 20. Clarendon Press, Oxford 1974. 78 pages. £1.20.

Air Pollution Abatement & Regional Economic Development. William H. Miernyk and John T. Sears. Lexington Books. 1974. 190 pages.

Air Quality Instrumentation, Vo. 2. J. W. Scales. Instrument Society of America. 1974. 326 pages. £6.50.

Aspects of Pollution Associated with the Process Industries. D. H. Napier. A Keith Shipton Developments Special Study. Published in association with Woodhead-Faulkner Ltd.

Atmospheric Diffusion—2nd Edition. F. Pasquill. Ellis Horwood Ltd. 1974. £16.

Biological Monitoring for Industrial Chemical Exposure Control. A. L. Linch. C.R.C. Press. 1974. 188 pages. $36.

Cadmium in the Environment—2nd Edition. The Chemical Rubber Company Press. 1974. $31.95.

The Chemistry of Polychlorinated Biphenyls. The Chemical Rubber Company Press. 1974. £18.69.

Clearing the Air, Federal Policy on Automotive Emissions Control. Henry D. Jacoby, John D. Steinbruner and others. John Wiley & Sons. 1974. 213 pages. £7.20.

Combustion-Formation & Emission of Trace Species. Henry D. Jacoby, John D. Steinbruner and others. John Wiley & Sons. 1974. 213 pages. £7.20.

Control of Pollution Act 1974. J. F. Garner. Butterworths. 1975. 157 pages. £5.85.

Directory of Pollution Control Equipment Companies in the E.E.C. Ed. R. Whiteside and H. C. H. Whiteside. 1974. 403 pages. £9.75.

Dust Control and Air Cleaning. R. G. Dorman. International Series of Monographs in Heating, Ventilation and Refrigeration. Vol. 9. Permagon Press. 1974. 615 pages. £15.00.

Energy Environment Abstracts. Pollution Abstracts Inc. 1975. 977 pages.

Environmental Damage Costs. OECD Seminar, 1972. OECD 1974. 332 pages. £4.50.

Environmental Pollution by Chemicals. Colin Walker. Hutchinson Educational. 1971. 108 pages. £1.05

Environmental Protection in the Aluminium and Non-Ferrous Smelting Industry. Symposium—English translation by E. J. Groom, Esq. Technicopy. 1973. 306 pages. £15.00.

Everyday Meteorology. A. Austin Miller and M. Parry. Hutchinson Educational. Revised Edition. 272 pages. £4.95.

Health and Safety at Work Act—A Practical Handbook. Dr. W. T. Jones. Graham & Trotman Ltd., 1975. £5.50.

Health and Safety—The New Law. James Jackson. Commercial Publishing Co. 1975. £5.00.

Industrial Air Pollution Control. Noll & Duncan. Ann Arbor Science, 1973. 343 pages. $20.00.

Industrial Waste: Its Handling, Disposal and Re-Use. A. W. Neal. Claude Gill Books. 1971. £3.00.

The Law Relating to Noise. C. S. Kerse. Oyez. 1975. 188 pages. £3.50.

Management of Plutonium—Contaminated Solid Wastes. Proceedings of the 1974, Marcole Seminar, organised by the OECD Nuclear Energy Authority.

Man & His Environment: Waste. Wesley Marx. Harper & Row. 179 pages. £1.75.

Odour Pollution of Air: Causes and Control. W. Summer. Leonard Hill. 1971. 310 pages. £6.60.

Oil: the biggest Business. Christopher Tugendhat and Adrian Hamilton. Eyre Methuen. Revised Edition 1975. 404 pages. £6.25.

Perspectives on Energy. Ed. L. O. Ruedisili and M. W. Firebaugh. Oxford University Press. 1975. 527 pages. £4.00.

Philosophy & Environmental Crisis. Ed. William T. Blackston. University of Georgia Press. 1974. 140 pages. $4.50.

Pollution: The Effluence of Affluence. Ed. F. Taylor, P. Kettle, R. Putnam. Methuen. 1971. 215 pages. £2.00.

Pollution Engineering Practice Handbook. Ed. Cherimisinoff & Young. Ann Arbor Science. 1975. 1073 pages. £9.72.

The Pollution Handbook. Richard Mabey/ACE. Penguin Educational. 1974. 144 pages. 70p.

Prevention of Air Pollution in the Non-Ferrous Metals Industries. E. C. Mantle. Manual prepared by BNF Metals Technology Centre. 1974. 200 pages. £32.00.

Principles of Water Quality Control. T. H. Y. Tebbutt. Permagon Press. Rep. 1974. 179 pages. £1.80.

The Protection Handbook of Industrial Noise Control. 2nd Edition. Peter Sutton. Alan Osborne. 1975. 44 pages. £1.00.

The Protection Handbook of Pollution Control. Peter Sutton. Alan Osborne. 1975. 80 pages. £1.50.

Problems of the Environment. Peter F. Brooks. Harrap Books. 1974. £2.85.

Solid Wastes—Origin, Collection, Processing and Disposal. Ed. C. L. Mantell. John Wiley & Sons. 1975. £22.00.

Trace Elements in the Atmosphere. Hans Israel and Gerhard W. Israel. Ann Arbor Science. 1974. 158 pages. $15.00.

GOVERNMENT REPORTS/WHITE PAPERS

Control of Pollution Act 1974 Ch. 40. HMSO £1.22.

Health and Safety at Work etc. Act 1974. Ch. 37. HMSO £1.03.

H.M. Chief Inspector of Factories Annual Report 1973. Department of Employment. HMSO £1.10.

Technology and the Environment. Reports from Scientific Counsellors Overseas No. 8. Department of Industry, 1975.

ANNUAL REPORTS

British Gas Corporation—Annual Report & Accounts 1974-75.

CEGB Annual Report & Accounts 1974-75. £1.00.

The Committee for Environmental Conservation (CoEnCo) Report for 1974.

The Electrical Association for Women. 50th Annual Report, 1974-75.

Electricity Council Annual Report & Accounts 1974-75.

Environment Protection Authority of Victoria Annual Report. 1973-74.

The Greater London Council's Scientific Branch, Director General's Department. Annual Report of the Scientific Advisor, 1973. G.L.C. £4.25.

National Coal Board. Reports, Accounts and Statistical Tables 1974-75.

Solid Smokeless Fuels Federation Annual Report 1974-75.

CONFERENCE PAPERS

APCA 67th Annual Meeting. Denver, Colorado 1974. (200 papers, titles available on request).

APHI Environmental Health Congress. October 1974, Torbay. Proceedings of Conference.

Institute of Solid Wastes Management. Papers presented at the 77th Annual Conference, 1975.

Institution of Chemical Engineers. Papers presented at the London Chemical Engineering Congress 1975.

RESEARCH PAPERS AND REPORTS

An Assessment of the Hayes Shell-Cast Cokeless Cupola. L. Bergqrist, R. J. Taft. Esso Research Centre, Abingdon, Berkshire.

Britain's Nuclear Workhorses. Arthur Hawkins (April '75 address), CEGB, May 1975.

Chemical and Biochemical Methodology for the Assessment of Hazards of Pesticides for Man. WHO Scientific Group Report. (Technical Report Series No. 560) 1975.

The Determination of Atmospheric Sulphur Dioxide after Collection on Impregnated Filter Paper. C. Healey & D. F. Atkins U.K. AERE. Harwell. Feb. 1975. 50p (HMSO).

The Determination of Sulphur Dioxide in the Ambient Atmosphere—A survey of some interference effects. Technical Report by G. B. Marshall, Central Electricity Research Laboratories, August 1974.

The Dispersion from a Complex of Stacks: Calculations with Data from several Industrial Complexes in the vicinity of Ingolstadt (Western Germany). Report No. 3/74. Prepared by Concawe Air Pollution Special Task Force 1: Stichting Concawe, The Hague.

Environment Contaminants Inventory Study No. 2. The production, use and distribution of Cadmium in Canada. D. B. Lymburner. Environment Canada, Report Series No. 39.

Existing Environmental Regulations of Concern to the Oil Industry in Western Europe. Stichting Concawe, Report No. 6/75.
"Experts on Desulphurisation"—Stichting Concawe, The Hague.

Health Aspects of Environmental Pollution Control: Planning and Implementation of National Programmes. Report of a WHO Expert Committee. WHO Technical Report Series. 1974. No. 554. 57 pp. Sw Fr. 6.

Health Guide to BP Petroleum Products. 50p.

Incineration of Refinery Wastes. Stichting Concawe, Report No. 2/75.

Methods for the Determination of Nitrogen Oxides in Atmosphere. Stichting Concawe, Report No. 5/75.

New Agricultural Landscapes. October 74 (paper). Countryside Commission.

On the Effects of Water, Soil and Vegetation of an Increasing Atmospheric Supply of Sulphur. Nils Malmer. National Sewdish Environment Protection Board. 1974.

Preparation of peroxyacetyl nitrate (PAN) and its determination in the atmosphere. F. J. Sandells, S. R. Penkett, B. M. R. Jones. U.K. AERE Harwell. Nov. 1974. 50p (HMSO).

Progress in the Prevention and Control of Air Pollution in 1974. Report to Congress. U.S. EPA.

Public Perceptions of Water Quality and their effect on Water-Based Recreation. J. G. M. Parkes. Environment Canada, Social Science Series, No. 8.

Reports produced by the Secretariat or Working Group Members of Stichting Concawe. Stichting Concawe, The Hague, Report No. 1/75.

The Response of Local Government to the U.K. Clean Air Act, 1956: A case study in the adoption of permissive environmental legislation. Dr. L. T. Foster. Ph.D. Thesis.

"A Study of the Costs of Residue & Gasoil Desulphurisation for the Commission of the European Communities"—Supplement to report number 13/72. Prepared by R. J. Ellis, Chairman of the Cancowe Ad Hoc Group.

Sunsurface Disposal of Wastes in Canada—III. Regional Evaluation of Potential for Underground Disposal of Industrial Liquid Wastes. R. O. van Everdingen. Environment Canada Technical Bulletin No. 82.

Surface Water Data. Reference Index, 1974. Environment Canada, Inland Waters Directorate.

Survey on Nitrogen Oxide Emissions from Stationery Sources and Techniques for Reducing these Emissions. Stichting Concawe, Report No. 4/75.

Guide to Publications

This list of available publications on smoke prevention, atmospheric pollution and allied subjects is issued by the Society as a reference guide.

Prices quoted are those current at the date of publication, and are subject to variation. Please add 20% of the total cost of publications for postage and packing, with a minimum addition of 10p and a maximum of 75p. These charges do not apply to orders for the Society's leaflets nor to bulk orders of any one publication or publications.

All orders are sent by second-class mail or parcel post; if specifically requested, publications will be sent by first-class mail, air mail, registered post etc, but the additional costs incurred will be charged.

Information about older, out-of-print, and overseas publications may be obtained from the Society on request. Most of these are in the Society's library and can be consulted, or in some cases borrowed for short periods, by arrangement.

The Society operates a photocopy service, for out of print literature, etc. The price is 7p per page.

N.S.C.A. PUBLICATIONS

General

"Clean Air"
The journal of the Society. It contains articles, photographs, reports, news items, abstracts and other current information appertaining to air pollution and allied matters. Subscription rate £2·25 per calendar year post free. Single copies 75p.

"Sulphur Dioxide"
An examination of sulphur dioxide as an air pollutant.
2nd edition—revised and updated.
Price: £1.00

"Air Pollution from Road Vehicles"
Problems and control of air pollution from diesel and petrol motor vehicles.
Price: 20p

"Fumifugium" or "The Smoake of London Dissipated"
John Evelyn's well-known tract (1661).
Price: 25p

"Towards Cleaner Air"
Completely revised and updated.
Price: 50p

"Pollution"
An introduction to the whole subject of pollution for school children and students up to 'O' level standard.
Price: 10p

DES VOEUX MEMORIAL LECTURES

All at 10p each

"The Destructive Effects of Air Pollution on Materials"
Dr. A. Parker, 1955

"Meteorology and Air Pollution"
Sir Graham Sutton 1957

"Clean Air, Urban Amenity and the Growth of Towns"
Sir William Holford 1958

"Clean Air, Public Opinion and the Press"
Sir Linton Andrews 1960

"Clean Air and Future Energy"
Dr. E. F. Schumacher 1967

CONFERENCE PROCEEDINGS

Details of earlier Conference Proceedings available on request.

Harrogate Conference, 1960. The Des Voeux Memorial Lecture — "Clean Air, Public Opinion and the Press," Address by Parliamentary Secretary, Ministry of Housing and Local Government, Series of progress reports on (1) Research and Investigation; (2) Domestic Heating; (3) Industrial Problems, Papers on Air Pollution from Road Vehicles, and an Inquiry into the Working of the Clean Air Act.
Price: £1.25

Brighton Conference, 1961. Opening Address by John C. George, Parliamentary Secretary, Ministry of Power, Presidential Address by Lord Cohen of Birkenhead. Reports on National Survey of Air Pollution. Furnace Operators Bill, Diesel Smoke; Papers on Industrial Aspects of the Clean Air Act, Whole House Heating, Smoke Control Areas and Transatlantic Discussion.
Price: 75p

Harrogate Conference, 1962. Five papers on air pollution in European Countries, a paper on the 1958 Alkali order Processes followed by a paper on Incineration and Waste Disposal.
Price: 25p (Preprints only)

Scarborough Conference, 1963. Address by The Rt. Hon. Lord Hastings, Papers on Smoke Control Areas and their Problems, The Importance of Public Relations, Air Pollution—The Human Problem, Pollution from Road Vehicles, Progress in a Heavy Chemical Industry, The Warwickshire Clean Air Council, Five papers on Research and Development and two papers on grit and dust emissions.
Out of print—photocopy service available.

Harrogate Conference, 1964. Opening Address by the Rt. Hon. Lord Sherfield. Presidential Address by Dr. Albert Parker. Smoke Control Area Reports from eight regions: two papers on Air Pollution and Town Planning, four papers on the future supply of smokeless Fuel; Des Voeux Memorial Lecture—"A Century of Achievement"; a paper on road vehicle pollution and discussion on the Sulphur Dioxide Report.
Price: £1.25

Eastbourne Conference, 1965. Opening Address by John Morris, M.P., Parliamentary Secretary, Ministry of Power, Presidential Address by Sir Alan Wilson, F.R.S. Three Reports on Successes with Smoke Control; two papers on solid fuel distribution and supply problem; air pollution and mortality; odour control; control of pollution from road vehicles; four papers on new horizons in domestic heating; two papers on industrial problems; two papers on unresolved problems in air pollution.
Price: £1.25

Blackpool Conference, 1967. Opening Address by Stephen Swingler, M.P., Ministry of State, Ministry of Transport, Presidential Address by Sir John Charrington. Report on Air Pollution from road vehicles: some specific air pollution problems; Clean Air and the North West Environment; two papers on effects of pollution on environment; Des Voeux Memorial lecture—"Clean Air and Future Energy"; a paper on the emission of grit and dust from furnaces; the cost of smoke control; a report on smokeless heating in new housing, industrial and municipal incineration of refuse; paper on new oxygen-fuel process in steelmaking.
Price: £1.00 (Preprints only)

Harrogate Conference, 1968. Part I: Four papers on Clean Air and Future Fuel Usage, three papers on Chimneys: Progress on Scheduled Works; three papers on the Measurement of Pollution; three papers on Vehicles; Paper on Practical Problems in the Approach to Smoke Control.
Out of print—photocopy service available.
Part II: Opening Address by Sir David Pitblado, K.C.B., C.V.O. Presidential Address by Sir John Charrington and Reports of Discussions.
Price: 75p

Eastbourne Conference, 1969. Part I: Paper on Outstanding Problems in the Heavy Clay and Refractories Industry; The Pottery Industry's Contribution to Clean Air; Air Pollution Control in Oil Refining; Paper on Sulphur Oxides and Fuel Oils, Clean Air and Health in London; Dust Control in the Cement Industry and two papers on Iron and Steel—Progress Towards Clean Air. (A) Review of Progress. (B) Some Practical Problems.
Out of print—photocopy service available.
Part II: Opening Address by Lord Delacourt-Smith, Presidential Address by Sir Kenneth Hutchison on behalf of Baroness Serota and Reports of Discussions.
Price: £1.00

Southport Conference, 1970. Part I: Two papers on the Clean Air Act 1968; Paper on The Disposal of Refuse by Incineration; three papers on Conservation; three papers on Clean Air—the Balance Sheet; four papers on the Fuel Industry's Viewpoint; and two papers on Vehicle Pollution.
Price: £2.00
Part II: Opening Address by Eldon Griffiths M.P. Presidential Address by Sir Kenneth Hutchison, Reports of Discussions, and the paper Conservation in the North-West.
Price: £1.25

Folkestone Conference, 1971. Part I: A report by the Society's Technical Committee on Sulphur Dioxide, two papers on Odours and their Control, three papers on the Meteorological aspects of Air Pollution, three papers on Aircraft Pollution and a paper on the National Survey—Trends in Pollution.
Price: £2.50
Part II: Opening address by Sir Eric Ashby, Presidential Address by Stanley E. Cohen, Reports of the Discussions.
Price: £1.50

Scarborough Conference, 1972.
Part I:
1. Pollution Control—How far can we go ?
   Prof. C. J. Stairmand
2. Metals in the Atmosphere
   R. A. Fish
3. The Scheduled Processes
   F. E. Ireland
4. The Chemical Industry and Air Pollution
   F. Whiteley
5. Odour Nuisances in Industry
   T. R. Jones
6. Odour Nuisances in Agriculture
   Dr. F. H. Peakin
7. Effects of Air Pollution on Plants
   Dr. L. H. P. Jones and D. W. Cowling

Part II: Opening Address by Lord Kearton, Presidential Address by Stanley E. Cohen and Reports of Discussions.
Price: 50p per paper or £5.00 complete set together with Part II.

Torquay Conference 1973.
Part I:
1. Smoke Control—A Stocktaking of the Present Position
   Mrs. A. Moss
2. Dartmoor Under Pressure
   Lady Sayer
3. The Invasion of the South West's Environment
   P. Turnbull
4. Control of Emission from Combustive and Non-Combustive Sources
   K. Darby and K. R. Parker
5. Living in Polluted Cities
   F. J. C. Amos
6. Pollution and Health
   Dr. R. Murray
7. The Effects of Some Air Pollutants on Farm Animals
   Dr. L. H. P. Jones and D. W. Cowling
8. The Effect of Pesticides on Life in the Soil
   J. Newman
9. Effects of Nitrates on Farm Animals
   A. H. Walters

Part II: Opening Address by D. Davies, Presidential Address by H. B. Greenborough, and Reports of Discussions
Price: 50p per paper or £5.00 complete set together with Part II

Cardiff Conference 1974.
Part I:
1. New Legislation affecting the Environment and its Implications and Effects
   W. Bate
2. Environmental Pollution: The Technical Aspects of Co-operation Between Industry and the Local Authority
   Dr. R. Jenkins
3. The Propagation and Screening of Traffic Noise
   T. W. Heppell
4. Preliminary Findings of the Five Towns Survey
   Dr. R. G. Derwent and Dr. H. N. Stewart
5. The Prevention of Pollution from the Coal Industry
   D. H. Broadbent
6. The Prevention of Pollution from the Steel Industry
   Dr. A. O'Connor
7. Wild Life and the Effects of Pollution
   Professor K. Mellanby
8. The Measurement of Heavy Metals in the Atmosphere and their Interpretation
   N. J. Pattenden

9. The Use of Moss-Bags as Deposition Gauges for Airborne Metals
   Professor G. T. Goodman, S. Smith, G. D. R. Parry and M. J. Inskip

Part II: Civic Welcome and Opening Address by The Right Worshipful the Lord Mayor of Cardiff, Presidential Address by H. B. Greenborough and Reports of Discussions
Price: 50p per paper or £5.00 complete set together with Part II

Brighton Conference 1975.
International Clean Air and Pollution Control Conference.
Part I:
INTERNATIONAL ATTITUDES TO THE CONTROL OF POLLUTION
1. A Comparison of Approaches
   Dr. L. E. Reed and Dr. W. T. Westaway

The United Kingdom Approach and its Application
2. By Central Government
   M. F. Tunnicliffe
3. By Local Government
   T. H. Iddison

The European approach and its application
4. Pollution Control in the European Economic Community
   S. P. Johnson (Commission of the European Communities)
5. Criteria and Standards for the Protection of Man and his Environment in the Environmental Action Programme of the European Communities
   Dr. P. Recht, J. Smeets and W. Hunter (Commission of the European Communities)
6. A New Approach to Standards
   Dr. L. A. Clarenburg (Netherlands)

ENERGY FROM THE CONTINENTAL SHELF
7. Exploration
   J. M. Bowen
8. Production and Pollution Control
   F. G. Larminie
9. North Sea Oil—In Context and Perspective
   H. B. Greenborough

TECHNICAL ASPECTS OF THE CONTROL OF INDUSTRIAL POLLUTION
10. The Prevention of Pollution by Gases from Industrial Installations
    J. P. Detrie (France)
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SECTION 9

DIRECTORIES

Page

Directory of Consultants.. 152

Directory of Organizations 155

The International Union of Air Pollution Prevention Associations .. 160

Environmental Protection Equipment Manufacturers' Association .. 161

The Industrial Gas Cleaning Association 161

Trade Directory and Buyers' Guide

  Alphabetical Listing 163

  Classified Entries 168

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Chief Inspector for Scotland, HM Industrial Pollution Inspectorate for Scotland, Scottish Development Department, 21 Hill Street, Edinburgh EH2 3JY (031-226 5208).

Clean Air Council, Department of the Environment, Queen Anne's Chambers, 28 Broadway, London SW1H 9JU (01-930 4300, ext. 471).

Clean Air Council for Scotland, Scottish Development Department, Room F1/249, Government Buildings, Broomhouse Drive, Saughton, Edinburgh EH11 3UX (031-443 4040, ext. 875).

Derbyshire Advisory Council for Clean Air and Noise Control, Town Clerk's Office, Town Hall, Chesterfield (0246-77232).

The Greater Manchester Council for Clean Air and Noise Control, Environmental Health Department, Town Hall, Manchester M60 2JS (061-236 3377, ext. 2591/2).

Institution of Chemical Engineers, 15 Belgrave Square, London SW1X 8PT (01-235 3647).

Institute of Petroleum, Atmospheric Pollution Committee, Secretary: P. Jones, 61 New Cavendish Street, London W1M 8AR (01-636 1004).

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Northern Ireland Division: 20 Kensington Gardens, Belfast BT5 6NP (Castlereagh 461).

Northern Division: Health and Social Services Dept., Civic Centre, Barras Bridge, Newcastle upon Tyne (0632-28520).

North West Division: 129 Chorley Road, Swinton, Manchester M27 2AD (061 794-4711, ext. 293).

Yorkshire Division: Municipal Buildings, Pontefract, Yorkshire (Pontefract 72383).

West Midlands Division: Environmental Health Dept., P.O. Box 14, Council House, Halesowen B63 3AF (021-550 1651).

East Midlands Division: Health Dept., Castlefield House, Main Centre, Derby (0332-31111).

London and South East Division and Central Southern Division: Town Hall, Bath Road, Slough SL1 3UG (0753 23881).

South West Division: Environmental Health Dept., Union House, Union Street, Bristol BS1 2DN (0272 26241).

South and Mid Wales: 9 Lodge Drive, Baglan, Port Talbot (Port Talbot 5231).

Royal Institute of Chemistry, 30 Russell Square, London WC1B 5DT (01-580 3482).

Teesside Clean Air and Noise Abatement Committee, Secretary's Department Langbaurgh Town Hall, Fabian Road, South Bank, Middlesbrough, Cleveland TS6 9AR (06495 68141).

Warwickshire Environmental Protection Council, c/o Warwick District Council, Town Hall, Leamington Spa, Warwickshire (0926 27072).

Yorkshire and Humberside Advisory Council for Clean Air and Noise Control, J. A. Hinchliffe, Environmental Health Department, Municipal Offices, Pontefract, Yorkshire (Pontefract 72383).

FUEL AND ENERGY

BP Oil Limited, BP House, Victoria Street, London SW1E 5NJ (01-821 2000).

British Carbonization Research Association, Chesterfield, Derbys (Chesterfield 76821).

British Gas Corporation, 59 Bryanston Street, Marble Arch, London W1A 2AZ (01-723 7030).

Central Electricity Generating Board, Sudbury House, 15 Newgate Street, London EC1A 7AU (01-248 1202).

College of Fuel Technology, 90 Talbot Road, Highgate, London N6 4RB (01-340 6972).

Combustion Engineering Association, Beaufort Chambers, 240B High Street, Slough, Bucks. (Slough 33211).

Domestic Solid Fuel Appliances Approval Scheme, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020, ext. 21).

Electrical Association for Women, 25 Foubert's Place, London W1V 2AL (01-437 5212/3).

Electrical Research Association Ltd., Cleeve Road, Leatherhead, Surrey (Leatherhead 74151). Telex 264045.

Electricity Council, 30 Millbank, London SW1P 4RD (01-834 2333).

Esso Petroleum Co. Ltd., Victoria Street, London S.W.1. (01-834 6677).

Industrial Gas Cleaning Association, 15 Tooks Court, London EC4A 1LA (01-242 7161).

Institute of Fuel, 18 Devonshire Street, London W1N 2AU (01-580 7124).

Institution of Electrical Engineers, Savoy Place, London WC2R 0BL (01-240 1871).

Institution of Gas Engineers, 17 Grosvenor Crescent, London SW1X 7ES (01-245 9811).

Institution of Heating and Ventilating Engineers, 49 Cadogan Square, London SW1X 0JB (01-235 7671/2/3).

Low Temperature Coal Distillers' Association of Great Britain Ltd., P.O. Box No. 21, Chesterfield, Derbyshire (0246 822281/9).

National Coal Board, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020).

NIFES (National Industrial Fuel Efficiency Service Ltd.).

Registered office:
Orchard House, 14 Great Smith Street, London SW1P 3BU (01-222 0961).

Offices:
84 High Street, Buntingford, Herts. SG9 9AJ (0763 71154).
88 Cathedral Road, Cardiff, CF1 9LN (0222 33825).
Wellington House, 190, Derby Road, Nottingham, NG7 1NR (0602 44753).
26 Calthorpe Road, Edgbaston, Birmingham, B15 1RP (021-454 4471).
N.I.F.E.S. House, Sinderland Road, Broadheath, Altrincham, Cheshire, WA14 5HQ (061-928 5791).
Rawdon House, Green Lane, Yeadon, Nr. Leeds LS19 7BY (0532 505943).
26 Portland Terrace, Jesmond, Newcastle upon Tyne, NE2 1QJ (0632 813776).
6 Park Terrace, Glasgow, G3 6BY (041-332 2453).
49 Meadowside, Dundee, DD1 1EQ (0382 22179).

Shell Marketing Limited, Industrial Markets Division, P.O. Box No. 148, Shell-Mex House, Strand, London WC2R 0DX (01-836 1234).

Society of British Gas Industries, 56-58 Holly Walk, Leamington Spa, Warwickshire (Leamington Spa 34357).

Solid Smokeless Fuels Federation, York House, Empire Way, Wembley, Middlesex HA9 0PA (01-902 5405).

Women's Solid Fuel Council, Hobart House, Grosvenor Place, London SW1X 7AE (01-235 2020).

Women's Gas Federation and Young Homemakers, Gaywood House, 29 Great Peter Street, London SW1P 3LW (01-222 3677/0).

GENERAL

British Society for Social Responsibility in Science, 9 Poland Street, London W1 3DG (01-437 2728).

City and Guilds of London Institute, 76 Portland Place, London W1N 4AA (01-580 3050).

National Council of Women of Great Britain, The, 36 Lower Sloane Street, London SW1W 8BP (01-730 0619).

National Council of Social Service, The, 26 Bedford Square, London WC1B 3HU (01-636 4066).

Royal Institution of Great Britain, 21 Albemarle Street, London W1X 4BS (01-493 0669 and 5716).

GENERAL ENVIRONMENT AND CONSERVATION BODIES

Committee for Environmental Conservation, 29-31 Greville Street, London EC1N 8AX (01-242 9647).

Conservation Society, 12 London Street, Chertsey, Surrey KT16 8AA (Chertsey 60975).

Conservation Trust (Educational Aspects), 228 London Road, Earley, Reading, Berks. (0734-663281).

Council for the Protection of Rural England, 4 Hobart Place, London SW1W OHY (01-235 9481).

Council for the Protection of Rural Wales (Cymdeithas Diogelu Harddwych Cymru), Meifod, Powys SY22 6DA (Meifod 383).

Countryside Commission, John Dower House, Crescent Place, Cheltenham, Glos GL50 3RA (0242 21381).

Environmental Sciences Research Unit, College of Aeronautics, Cranfield Institute of Technology, Cranfield, Bedford (Bedford (0234) 750111).

National Trust for Places of Historical Interest or Natural Beauty, 42 Queen Anne's Gate, London SW1H 9AS (01-930 1841/0211).

Royal Commission on Environmental Pollution, Church House, Great Smith Street, London SW1P 3BL (01-212 8620).

GOVERNMENT AND LOCAL BODIES

Association of District Councils (represents all of the new 333 district councils in England and Wales), 25 Buckingham Gate, London SW1E 6LE (01-828 7425).

Association of Metropolitan Authorities, 36 Old Queen Street, Westminster, London SW1H 9JE (01-930 9861).

Atomic Energy Research Establishment, Harwell, Oxon OX11 0RA (Abingdon (0235) 24141).

Association of County Councils, Eaton House, 66A Eaton Square, Westminster SW1W 9BH (01-235 5173).

Convention of Scottish Local Authorities, 3 Forres Street, Edinburgh EH3 6BL 031-225 1626/7).

Department of the Environment, 2 Marsham Street, London SW1P 3EB (01-212 3434).
Clean Air Division: Queen Anne's Chambers, 28 Broadway, London SW1H 9JU (01-930 4300).
(Also see Alkali and Clean Air Inspectorate).

Department of Energy, Thames House South, Millbank, London SW1P 4QJ (01-211 3000).

Department of Industry, Industrial and Commercial Policy Division, 1 Victoria Street, London SW1H 0ET (01-215 7877).

Her Majesty's Stationery Office, Atlantic House, Holborn Viaduct, London EC1P 1BN (01-248 9876), and at Sovereign House, Botolph Street, Norwich NR3 1DN (Norwich 22211).

London Boroughs Association, Westminster City Hall, Victoria Street, London SW1E 6QW (01-828 8070).

Parliamentary and Scientific Committee, 30 Farringdon Street, London EC4A 4EA (01-236 3011).

Scottish Development Department, Room F1/247, Government Buildings, Broomhouse Drive, Saughton, Edinburgh EH11 3UX (031-443 4040, ext. 860).

Standing Conference of Co-operating Bodies, Warren Spring Laboratory (Department of Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

Warren Spring Laboratory (Department of Industry), P.O. Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX (0438 3388).

HEALTH

British Medical Association, B.M.A. House, Tavistock Square, London WC1H 9JP (01-387 4499).

Department of Health and Social Security, Alexander Fleming House, Elephant and Castle, London SE1 6BY (01-407 5522).

Environmental Health Officers Association, The, 19 Grosvenor Place, London SW1X 7HU (01-235 5158/9).

Health Education Council, 78 New Oxford Street, London WC1A 1AH (01-637 1881).

Institute of Hospital Engineering, 20 Landport Terrace, Southsea, Hampshire PO1 2RG (0705 23186).

Institution of Public Health Engineers, 32 Eccleston Square, London SW1V 1PB (01-834 3017).

Medical Research Council, Air Pollution Unit, St. Bartholomew's Hospital Medical College, Charterhouse Square, London EC1M 6BQ (01-253 1537).

Royal Institute of Public Health and Hygiene, 28 Portland Place, London W1N 4DE (01-580 2731/2).

Royal Sanitary Association of Scotland, The, Bank of Scotland Building, 224 Ingram Street, Glasgow G1 1HH (041-248 7955).

Royal Society of Health, 13 Grosvenor Place, London SW1X 7EN (01-235 9961/5).

Society of Community Medicine, Tavistock House South, Tavistock Square, London WC1H 9LD (01-387 3923).

INDUSTRY, INSTRUMENTS AND STANDARDS

British Industrial Measuring and Control Apparatus Manufacturers' Association, 20 Peel Street, London W8 7PD (01-727 2614).

British Combustion Equipment Manufacturers Association, The Fernery, Market Place, Midhurst, West Sussex GU29 9DP (073-081 2782).

British Standards Institution, British Standards House, 2 Park Street, London W1A 2BS (01-629 9000).

Confederation of British Industry, 21 Tothill Street, London SW1H 9LP (01-930 6711).

Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ (01-839 1211).

Institution of Plant Engineers, 138 Buckingham Palace Road, London SW1W 9SG (01-730 0469).

Scientific Instrument Manufacturers' Association of Great Britain, 20 Peel Street, London W8 7PD (01-727 2614).

Sira Institute Ltd., South Hill, Chislehurst, Kent (01-467 2636).

IRON AND STEEL

British Cast Iron Research Association, Alvechurch, Birmingham B48 7QB (Redditch 66414). Telex: 337 125.

British Independent Steel Producers Association, The, 5 Cromwell Road, London SW7 2HX (01-581 0231).

British Steel Corporation, P.O. Box 403, 33 Grosvenor Place, London SW1X 7JG (01-235 1212).

Council of Ironfoundry Associations, 14 Pall Mall, London SW1Y 5LZ (01-930 7171).

Institution of Corrosion Science and Technology, The, 14 Belgrave Square, London SW1X 8PS (01-245 9189).

Steel Castings Research and Trade Association, East Bank Road, Sheffield S2 3PT (0742 28647).

METEOROLOGY

Meteorological Office, London Road, Bracknell, Berkshire (0344 20242).

Meteorological Office, Weather Centres
Forecasts, London: 01-836 4311
Glasgow: 041-248 3451
Manchester: 061-832 6701
Newcastle: 0632 26453
Southampton: 0703 28844
Nottingham (Watnall): 060-75 3311.

Royal Meteorological Society, James Glaisher House, Grenville Place, Bracknell, Berks RG12 1BX (Bracknell 22957/8).

TRANSPORT

British Internal Combustion Engine Research Institute Ltd., 111-112 Buckingham Avenue, Slough, Berks SL1 4PH (Slough 27371).

Institute of Road Transport Engineers, The, 1 Cromwell Place, Kensington, London SW7 2JF (01-589 3744).

Motor Industry Research Association, The, Watling Street, Nuneaton, Warwickshire (Nuneaton 68541).

Road Haulage Association Ltd., The, 22 Upper Woburn Place, London WC1H 0ES (01-387 9711).

OVERSEAS

Argentine
*Asociación Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires.

Australia
*Clean Air Society of Australia and New Zealand, Box 100, P.O., Lane Cove, 2066, New South Wales.
Air Pollution Control Branch, N.S.W. Department of Health, P.O. Box 163, Lidcombe, N.S.W. 2141.
Commonwealth Scientific and Industrial Research Organisation, P.O. Box 225, Dickson A.C.T. 2602.
Department of Public Health, Box 65, Rundle Street, P.O., Adelaide, S.A. 5000.
Division of Air Pollution Control, Department of Health, 484 Adelaide St., Brisbane, Qld. 4000.
Environmental Control, Department of Labour and Industry, 81 Brisbane St., Hobart, Tas. 7000.
Environment Protection Authority, 232 Victoria Pde., East Melbourne, Vic.
Department of Public Health, 57 Murray St., Perth, W.A. 6000.

Austria
*Austrian Association for Industrial Medicine, Schwarzspanierstrasse 17, A1090 Vienna.

Belgium
Centre Scientifique et Technique de la Construction, rue du Lombard 41, B-1000 Brussels.

Brazil
Associação Brasileira de Prevenção à Poluição do Ar, Av. S. João, 1113-1°. andar, São Paulo, Brazil.

Canada
Department of the Environment, Environmental Protection Service, Air Pollution Control Directorate, Ottawa, Ontario, K1A 0H3, Canada.

Czechoslovakia
1. Technical University of Prague, Faculty of Mechanical Engineering, Environmental Engineering Department, Suchbátarova 4, Praha 6.
2. Czechoslovak Academy of Sciences, Institute for Physics of the Atmosphere, Boční 11, Praha 4.
3. Institute of Hygiene and Epidemiology, Institute of General and Communal Hygiene, Šrobárova 48, Praha 10.
4. Power Research Institute, Partyzánská 7a, Praha 7.
5. Research Institute of Air Engineering, Počernická 96, Praha 10.
6. Research Institute of Chemical Equipment, Počernicka 96, Praha 10.
7. Hydrometeorological Institute Department for Air Pollution Prevention, Na Šabatce 17, Praha 4–Komořany.
8. Slovak Hydrometeorological Institute, Jeseniova 43 Bratislava-Koliba.
9. State Technical Inspection for Air Pollution Centre, Italská 27, Praha 2.
10. Czechoslovak Research and Development Centre for Environmental Pollution Control–UNO/WHO Programme–Bratislava–Karlova Ves.

Denmark
Dansk Kedelforening and Danish Air Pollution Laboratory, Sankt Peders Vej 8, 2900 Hellerup.
National Health Service of Denmark, 1 St. Kongensgade, 1264 Copenhagen K.

Finland
Finnish Council for Air Conservation and Noise Abatement, Sörnäisten rantatie 3, 00530 Helsinki 53.
Ministry of Interior Affairs, Hallituskatu 4 E, 00170 Helsinki 17.

France
Association pour la Prévention de la Pollution Atmosphérique. M. Yvan QUERET. 62, rue de Courcelles, 75008 PARIS.

Association Technique de l'Industrie du Gaz en France, 62, rue de Courcelles, 75008 PARIS.
Centre d'Information pour le Dévelopement de Conditionnement d'Air, de la Ventilation, du Filtrage de l'Air et du Dépoussiérage, 38, rue de Copernic 75016 PARIS.
Centre Interprofessionnel Technique d' Etudes de la Pollution Atmosphérique (C.I.T.E.P.A.), 28, rue de la Source, 75016 PARIS.
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Centre d'Etudes et de Recherches de Charbonnages de France (CERCHAR) Boîte Postale No 27—60103 CREIL.
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2. Centre Interprofessional Technique d'Etudes de la Pollution Atmosphérique (C.I.T.E.P.A.). 28, rue de la Source 75016 PARIS.
3. Comité National d'Action pour l'Assainissement de l'Atmosphère (C.A.P.A.), 54 avenue Marceau 75008 PARIS.

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Délégation Générale à la Recherche Scientifique et Technique 103 rue de l'Université 75007 PARIS.
Electricité de France, Direction de la Production Thermique, 3 rue Henri Heine 75016 PARIS.
Institut Français des Combustibles et de l'Energie, 3 rue Henri Heine, 75016 PARIS.
Institut Français du Pétrole (I.F.P.) 1 et 4 avenue Bois Préau, 92 RUEIL MALMAISON.
Institut National de Recherche Chimique Appliquée, 12, Quai Henry IV, 75004 PARIS.
Laboratoire Central de la Préfecture de Police, 39 bis rue de Dantzig 75015 PARIS. "M. le Professeur CHOVIN".
Laboratoire d'Hygiène de la Ville de Paris, 1 bis rue des Hospitalières St. Gervais 75004 PARIS. M. Festy.
Laboratoire "Prévention de la Pollution Atmosphérique" d'Electricité de France, 1, quai de Saint Ouen 93—SAINT DENIS.
Professeur ROUSSEL, 11 bis rue de Milan, 75009 PARIS.
Société Française des Pétroles BP, 21 rue de la Bienfaisance, 75008 PARIS.
Centre d'Informations et de Recherches sur les Nuisances du Groupe ELF-ERAP-SNPA, 7 rue Nélaton 75015 PARIS. M. Bapseres.

Germany

Abgasprüfstelle der DDR, Rudower Chaussee 6, 1199 Berlin-Adlershof.
Agrikulturchemisches Institut, Am Vogelsang 14, 5628 Heiligenhaus Bez. Düsseldorf.
Bundesanstalt für Materialprüfung (BAM) 1000 Berlin 45, Unter den Eichen 87.
Bundesgesundheitsamt, Institut für Wasser-, Boden- und Lufthygiene, Corrensplatz 1, 1000 Berlin 33.
Bundesministerium des Innern, Rheindorfer Str. 198, 5300 Bonn.
Bundesverband der Deutschen Industrie, Abt. Umweltfragen 5 Köln 51, Oberländer Ufer 84-88.
Deutsche Gesellschaft für Mineralölwissenschaft und Kohlechemie e.V., 2 Hamburg 1, Steindamm 71.
Deutsches Krebsforschungszentrum Heidelberg, Institut für Toxikologie und Chemotherapie der Universität Heidelberg 69, Heidelberg 1, Kirschnerstr. 6.
Deutscher Städtetag, Lindenallee 11, 5000 Köln-Marienburg.
Deutscher Verein von Gas- und Wasserfachmännern, 6000 Frankfurt/Main 97, Theodor-Heuss-Allee 90-98.
Gaswärme-Institut Essen e.V., Holbeckshof, 4300 Essen-Steele.
Hygiene-Institut der Humboldt-Universität, Otto-Grotewohl-Str. 1, 108 Berlin, DDR.
Hygienisches Institut, Neuer Kamp 25, 2000 Hamburg 6.
Institut für Angewandte Botanik der Universität Hamburg 2000 Hamburg 36, Marseillerstr. 7.
Institut für Grubensicherheit und Arbeitsschutz, Kirchgasse 11, Freiberg/Sa., DDR.
Institut für Pharmakologie, Toxikologie u. Pharmazie d. Tierärztlichen Hochschule 3000 Hannover, Bischofsholer Damm 15.
Institut für Technische Physik der Frauenhofer-Gesellschaft, Königstr. 70/74, 7000 Stuttgart-Degerloch. Director: Prof. Dr.-Ing. Gösele.
International Union for Conservation of Life (IUCL) Secretariate: Institut für Biologie und Lebensschutz, 6229 Schlangenbad-Georgenborn.
Landesinstitut für Arbeitsschutz und Arbeitsmedizin, Kaiserallee 61, 7500 Karlsruhe.
Landesanstalt für Immissions- und Boden-nutzungsschutz des Landes Nordrhein-Westfalen, Wallneyer Str. 6, 4300 Essen.
Landesanstalt für Umweltschutz Baden-Württemberg Institut für Immissions-Arbeits- u. Strahlenschutz 75 Karlsruhe 21, Greisbachstr. 3.
Landwirtschaftlichaftlche Universität Hohenheim Institut für Tierernährung, Fachgr. 9, 7000 Stuttgart 70, Emil Wolff-Str. 8.
Medizinisches Institut für Lufthygiene und Silikoseforschung 4000 Düsseldorf, Gurlittstr. 53.
Ministerium f. Arbeit, Gesundheit u. Soziales des Landes NRW 4 Düsseldorf 1, Postfach 1134.
Rhein.-Westf. Technischer Überwachungs-Verein e.V., Steubenstr. 53, 4300 Essen.
Ruhrkohle Aktiengesellschaft, 43 Essen 1, Rellinghauserstr. 1.
Silikose-Forschungsinstitut Medizinische Abetilung, 4630 Bochum, Hunscheidtstr. 12.
Staubforschungsinstitut des Hauptverbandes, der Gewerblichen Berufsgenossenschaften e.V., Langwartweg 103, 5300 Bonn.
Steinkohlenbergbauverein Hauptstelle für Staub- und Silikosebekämpfung 43 Essen-Kray, Frillendorfer Str. 351.
Umweltbundesamt 1000 Berlin 33, Bismarckplatz 1.
Verein Deutscher Eisenhüttenleute, Breite Str. 27, 4000 Düsseldorf.
Verein Deutscher Ingenieure (VDI)—Kommission Reinhaltung der Luft—Graf-Recke-Str. 84, 4000 Düsseldorf, Secretary: N. Endell.
Vereinigung de Technischen Überwachungs-Vereine e.V. 43 Essen, Rott Str. 17.
VGB—Technische Vereinigung der Grosskraftwerksbetrieber e.V. 43 Essen, Klinkestr. 29/31.

India

Central Public Health Engineering Research Institute, Nehru Marg, Nagpur-3.
Central Labour Institute, Off Eastern Express Highway, Sion, Bombay-22 (DD).
Bhabba Atomic Research Centre, Health Physics Division, Trombay, Bombay.
Department of Civil Engineering, Jadavpur University, Calcutta-32.
Indian Standards Institution, 'Manak Bhawan', 9 Bahadur Shah Zafar Marg, New Delhi-1.
National Institute of Occupational Health, Opp. New Mental Hospital, Ahmedabad-16.
All-India Institute of Hygiene & Public Health, Section of Physiological & Industrial Hygiene, Calcutta.

Israel

*Ministry of Health, Division for Air Pollution and Radiation Control, 27 Prof. Shor Street, Tel-Aviv.
Public Council for the Prevention of Noise and Pollution in Israel, Tel-Aviv, P.O. Box 23047.

Italy

Associazione Termotecnica Italiana (ATI), Gruppo Studio Inquinamento Atmosferico (GSIA), Piazzale R. Morandi, 2-20121 Milano, Italy.
Consiglio Nazionale delle Ricerche Piazzale delle Scienze 7, Rome.
ENEL-Direzione Costruzioni Termiche e Nuclear, Via G.B. Martini, 3, Rome.
ESSO Standard Italiana—Environment Division, Piazza Industria, 46, Rome.
ILVA Society, Via Corsica 4, Genoa.
Institute of Hygiene, University of Ferrara, Corso Giovecca 173A, Ferrara.
Institute of Hygiene, University of Genoa. Via A. Pastore 1, Genoa.
Instituto di Ingegneria Sanitaria del Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milan.
Istituto Superiore di Sanità, Viale Regina Elena 299, Rome.
N.A.N.S. (Union of Nations for Fight against Noise and Smog), Belvedere Golfo Paradiso 49-16036-Recco-Genova.
Stazione Sperimentale per i Combustibili, Viale De Gasperi 3, San Donato Milanese, Milan.

Japan

The Institute of Public Health, 1-39, Shiba Shirogane Daimachi, Minato-Ku, Tokyo.
Japanese Union of Air Pollution Prevention Associations, c/o Industrial Pollution Control Association of Japan, Shuwa Toranomon No. 3 Bldg., Shiba-Nishikubosakuragawa-Cho, Minato-Ku, Tokyo 105.
Industrial Pollution Control Association of Japan, Shuwa Toranomon No. 3 Bldg., 18, Shiba-Nishikubosakuragawa-Cho, Minato-Ku, Tokyo 105.
Osaka Institute of Hygiene, 38 Kitaogimachi, Kita-Ku, Osaka.

Malta

National Society for Clean Air, 8-10 Civic Centre, Senglea.

Mexico

Asociacion Mexicana Contra la Contaminacion del Agua y del Aire, A.C., Torre de Ciencias 5° Piso, Ciudad Universitaria, México 20, D.F., México.

The Netherlands

Central Organization TNO, Juliana van Stolberglaan 148, The Hague.
Central Service for Environmental Control, Rijnmond, Stationsplein 2, Schiedam.
Council for Air Pollution, Ministry of Health and Environment, Dokter Reyersstraat 10, Leidschendam.
Division for Air Pollution, Gemeentelijk Bouw- en Woningtoezicht, Mauritskade 9-11, The Hague.
Environmental Health Division, Municipal Health Service, Baan 170, Rotterdam.
Laboratory for Water, Soil and Air Pollution, Municipal Health Service, Nieuwe Achtergracht 100, Amsterdam.
National Institute of Public Health, P.O.B. 1, Bilthoven.
Netherlands Association Against Water, Soil and Air Pollution, Schaep en Burgh, Noordereinde 60, 's-Graveland.
Organization for Health Research (TNO), Juliana van Stolberglaan 148, P.O.B. 297, The Hague.
Research Institute for Environmental Hygiene (TNO), Atmospheric Pollution Division, Schoemakerstraat 97, P.O.B. 214, Delft.
SICOM, Stichting Internationaal Contactorgaan Milieubescherming, Postbus 214, Delft.
Stichting Concawe (International Study Group for Conservation of Clean Air and Water in Western Europe), van Hogenhoucklaan 10, The Hague.

New Zealand

New Zealand Clean Air Society Inc., P.O. Box 2363, Christchurch, New Zealand.

Norway

Institute of Hygiene, University of Oslo, Gydas Vei 8, Oslo 3.
Stateus Fornreusingstilsyn, Oslo Dep., Oslo 1.
Norwegian Institute for Air Research, P.O. Box 15, N-2007 Kjeller/Oslo, Norway.
SINTEF avd. 21, 7034 Trondheim—NTH, Norway.
Norsk Forening for Bekjempelse av Luftforurensinger, tilknyttet NIF, Norske Sivilingeniørers Forening, Kronprinsensgt. 17, Oslo 2, Norway.

Peru

*Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire, Jr, Moquegua 336-Of. 206, Lima, Peru.

Poland

The Ministry of Administration, Local Economy and Environment Protection, Warsaw 02-056, Fittrowa 57.

Portugal

*Instituto Superior Ciencias, Sociais Universidade Técnica, Lisbon.

South Africa

Air Pollution Research Group of the Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, Transvaal.
Chemical Engineering Research Group of the Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, Transvaal.
D. Giles and Co. (Scientific) (Pty) Ltd., P.O. Box 3891, Johannesburg, Transvaal.
National Association for Clean Air, P.O. Box 5777, Johannesburg, Transvaal.

Spain

Municipal Institute of Hygiene, Place de Lesseps, 1 Barcelona.

Sweden

National Swedish Environment Protection Board, Fack S-17120. Solna.
Swedish Water and Air Pollution Research Laboratory, Box 5207, S-40224 Göteborg 5.
International Meteorological Institute in Stockholm, Arrheniuslaboratoriet, Fack, S-104 05, Stockholm.
Swedish Meteorological and Hydrological Institute, Fack, S-60101 Norrköping.
AB Bahco, Fack, S-19901 Enköping 1.
AB Svenska Flätfabriken, Fack, S-10460 Stockholm.

Switzerland

Eidgenössische Kommission für Lufthygiene, Schwarztorstr. 53, 3007 Berne.
Schweiz. Vereinigung für Gesundheitstechnik (SVG), Postfach 305, 8035 Zurich, Switzerland.

U.S.A.

Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, 15213.
Bituminous Coal Research Inc., 35 Hochberg Road, Monroe, Pittsburgh 13, PA.
National Air Pollution Control Administration, 801 N. Randolph Street, Arlington, Virginia 22203.

Other U.S. Governmental Air Pollution Agencies and individual State Agencies are listed in an annual Directory published by the Air Pollution Control Association in co-operation with the U.S. Dept. of Health, Education and Welfare. A copy of this Directory is available at the library of the National Society for Clean Air.

Uruguay

*Asociacion Uruguaya Contra la Contaminacion del Aires, Calle Colonia 1422, P.6, Ap. 601 Montevideo, Uruguay.

U.S.S.R.

Institute of Communal Hygiene, Pogodinskaja 10, Moscow.
Medical Control Committee on Air Pollution, State Medical Commission, Moscow.

Yugoslavia

Yugoslav Society for Clean Air, 71001 Sarajevo, Masinski fakultet, Yugoslavia.

Division of Environmental Health, World Health Organisation, Avenue Appia, 1211 Geneva 27, Switzerland.

The United Nations Economic Commission for Europe
Environment and Human Settlements Division, Palais des Nations, Geneva, Switzerland.

*Entry taken from NSCA Year Book 1975 as no reply received from enquiry.

The International Union of Air Pollution Prevention Associations

President: Mr. B. Shindo of the Japanese Union of Air Pollution Prevention Associations

The International Union was originally established in 1965 with six founder members—Argentina, France, Great Britain, Japan, United States of America, and West Germany. The Union consists of non-governmental organisations only and its primary functions are to promote collaboration and the exchange of information on air pollution and environmental problems and to organise, through its member associations, international congresses.

The first congress of the Union was held in London in 1966; the second International Clean Air Congress was held in Washington D.C., U.S.A., in December 1970 and the third International Congress was held in Dusseldorf, Federal Republic of Germany, in October 1973. The 4th Congress will be held in Tokyo, from 16th to 20th May 1977.

Since its inception in 1965 the I.U.A.P.P.A. has grown to fifteen full corporate members and four affiliate members.

CORPORATE MEMBERS:

Asociación Argentina Contra la Contaminación del Aire
Sarmiento 680, Buenos Aires, ARGENTINA
Prof. Dr. José A. RISPOLI, President
Prof. Dr. Damian D. TORTI, General Secretary

Clean Air Society of Australia and New Zealand
Box 100, P.O., Lane Cove, 2066, New South Wales, AUSTRALIA
John G. SCHRODER, President
Dr. W. STRAUSS, Council Member

Österreichische Gesellschaft zur Reinhaltung der Luft
A-8700 Loeben, Franz-Josefstrasse 18, Mont. Hochschule Loeben, AUSTRIA
Dipl.-Ing. W. FELBERMAYER, Secretary

Associação Brasileira de Prevenção à Poluição do Ar
Av. S. João, 1113-1° andar, São Paulo, BRAZIL
Randolfo Marques LOBATO, President
Engº. Fernando de A. GUIMARÃES, Vice-President

VDI-Kommission Reinhaltung der Luft
Graf-Recke-Str. 84, Postfach 1139, 4 Düsseldorf 1, FEDERAL REPUBLIC OF GERMANY
Prof. Dr. Heinrich SCHACKMANN, President
Dipl.Ing. Norbert ENDELL, Secretary

Association pour la Prévention de la Pollution Atmosphérique
62 Rue de Courcelles, 75008 Paris, FRANCE
Y. QUERET, President
Dr. M. SOMMER, General Secretary
J. R. DELANDRE, Director

National Society for Clean Air
136 North Street, Brighton BN1 1RG, ENGLAND
Professor P. J. LAWTHER, President
Rear Admiral P. G. SHARP, Secretary General

Associazione Termotecnica Italiana (ATI)
Gruppo Studio Inquinamento Atmosferico (GSIA), Piazzale R. Morandi, 2-20121 Milano, ITALY
Prof. Carlo PADOVANI, President

Japanese Union of Air Pollution Prevention Associations
c/o Industrial Pollution Control Association of Japan, Shuwa Toranomon No. 3 Building, 18 Shiba-Nishikubosakuragawa-Cho Minato-Ku, Tokyo 105, JAPAN

Yugoslav Society for Clean Air
71000 Sarajevo, Mašinski fakultet, YUGOSLAVIA
Prof. M. KRSTIC, President
M. FUGAS, Vice-president

SICOM, Stichting Internationaal Contactorgaan Milieubescherming
Postbus 214, Delft, THE NETHERLANDS
Dr. L. A. CLARENBURG, President

Asoc. Mexicana Contra la Contaminacion del Agua y del Aire, A.C.
Torre de Ciencias 5° Piso, Ciudad Universitaria, México 20, D.F., MEXICO
Ing. Humberto BRAVO A.

Schweiz. Vereinigung für Gesundheitstechnik (SVG)
Postfach 305, 8035 Zurich, SWITZERLAND
Walter HESS, President

National Association for Clean Air
P.O. Box 5777, Johannesburg, Transvaal, SOUTH AFRICA
Dr. A. STRASHEIM, Chairman
J. L. EASTERBROOK, Director

Air Pollution Control Association
4400 Fifth Avenue, Pittsburgh, PA. 15213, U.S.A.
Arthur C. STERN, President
Dr. Lewis H. ROGERS, Executive Vice-president

AFFILIATE MEMBERS:

The Public Council for the Prevention of Noise and Pollution in Israel
P.O. Box 23047, Tel-Aviv, ISRAEL
David SIVAN, Secretary General

Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.)
Norske Sivilingeniørers Forening, Kronprinsensgate 17, Oslo 2, NORWAY
Sivilingenior Ivar NESTAAS, Chairman
Alf REISTAD, Secretary

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire
Jr. Moquegua 336- Of. 206, Lima, PERU
Anibal GASTANAGA, President

Asociacion Uruguaya Contra la Contaminacion del Aires
Calle Colonia 1422, P.6, A. 601, Montevideo, URUGUAY
Dr. José Olivera UBIOS, President

ASSOCIATED ORGANISATION:

New Zealand Clean Air Society Inc.
P.O. Box 2363, Christchurch, New Zealand

The Environmental Protection Equipment Manufacturers' Association

EPEMA was inaugurated in September 1972 under the auspices of the National Society for Clean Air.

For some considerable time it had been felt by some members of the Society and by manufacturers of equipment for the abatement of pollution, that there should be some form of association of such manufacturers which could represent their views and have close links with the Society. After a series of talks and negotiations, it was felt in September 1972, that the time was right for a start to be made. Accordingly, the Association was launched and in the 3 years of its existence, with some administrative help from the Society, it is now becoming established and known.

EPEMA is a non-profit making Association financed entirely by the subscriptions from its members. It consists of manufacturers and installers of equipment designed to reduce and/or monitor pollution emitted to the environment; one of its main aims is, through its members, to seek to improve the standards of all equipment for the abatement and monitoring of pollution. To enable it to do this, the Association negotiates with appropriate government departments and through them with the E.E.C. The Association ensures that its members manufacture, market and install equipment of the required standard. In other words, the Association is endeavouring to provide protection for the consumer. In addition, the Association provides advisory service not only to its members but also to customers regarding supply, provision, installation and operation of a suitable pollution control and measuring or monitoring equipment; obviously, it is not in a position to act for such customers in a consultant capacity.

EPEMA is a member of the National Society for Clean Air; it is recognised as a national body and has as its representative on the Council of the Society, Mr. K. S. Dunn of the Incinerator Company Limited. The Association is also represented on the Society's Technical Committee by its Chairman, Mr. Max Beaumont of F. E. Beaumont Limited.

Further nformation may be obained from EPEMA, at 136 North Street, Brighton BN1 1RG.

The Industrial Gas Cleaning Association

The Industrial Gas Cleaning Association was formed in 1971 and its membership now comprises eleven companies who, collectively, design and supply the majority of plant and equipment for the control and cleaning of industrial effluent gases within the UK.

Although legislation to reduce industrial smoke and fume was first instigated nearly 100 years ago, and many firms have been producing equipment to ensure clean air for well over 70 years, it is only during the past decade or two that the importance of clean air to the quality of the community's life has been fully realised, not only in this country but throughout the world.

Every kind of modern processing industry can be a potential polluter of the atmosphere and the more sophisticated the materials to be processed the more complex a possible solution can be.

In times past a simple wood fire used to smoke kippers, bake bread or heat early foundries, may have smelt and created mild fumes, but the quantity of smoke and fumes emitted was unlikely to be very harmful to the individual or the quality of the local air.

However with the industrial revolution of the last century and the increasing use of coal and later coal gas as fuels, and the scope of products processed widened, so did the pall of dirty smoke. Even 'clean' electricity is generated in most cases by the burning of other fuels. With the introduction in the 20th century of oil, natural gas and atomic energy further pollutions of the atmosphere resulted. The ensuing killer 'smogs' of the late 1950's when climatic conditions prevented the escape of banks of fumes and gases hanging over cities dramatically drew the attention of people to the effects of air pollution.

With the implementation this year of the Health and Safety at Work Act, the working conditions and total environment of the employee are highlighted. The individual must not only be protected from visible hazards such as unguarded machinery but from invisible and sometimes long-term threats to health such as dust and noxious fumes.

The concentration and intensification of modern industrial processes such as are found in the iron and steel, cement, power and other basic industries have necessitated the refinement of earlier gas cleaning techniques and the development of new concepts of plant and equipment to provide increasingly high efficiencies of collection and higher standards of availability.

However it is only a slightly oversimplification to say that atmospheric pollution from industrial processes is caused by two types of pollutant, i.e. particulate and gaseous matter. Today the gas cleaning industry calls upon all the engineering disciplines to solve pollution problems many of which are of great complexity.

Equipment for separating particulate matter, i.e. solid particles from effluent air or gas can be classified as follows:—

i Cyclone collectors
ii Wet collectors
iii Fabric filters
iv Electrostatic precipitators

The removal of undesirable gaseous matter from effluents requires different techniques from those used in the foregoing equipment and may be broadly classified as follows:—

v Absorption processes
vi Adsorption processes
vii Combustion processes, either flame or catalytic.

For the treatment of effluents comprising both solid particles and gas, which are produced by many industrial processes, a combination of different types of equipment may be required, or modified versions of the first four.

It is hardly surprising, therefore, that the potential user of pollution control equipment faces, in turn, severe problems in the selection of the solution appropriate to his requirements.

It was partly to meet this customer need that the IGCA was formed. Many decades of experience are available from the members of the IGCA who are in a unique position to give practical help on technical and economic aspects. Much of today's argument and counter-argument is concerned with the costs of clean air. The Industrial Gas Cleaning Association, through its members, can play a most important part in providing technical and cost data so that the costs of clean air are minimised.

Amongst the aims of the IGCA is the dissemination of information designed to lead the user through the labyrinths of plant selection problems and to assist him towards the correct evaluation of proposals made to him by the suppliers of equipment. To this end the IGCA has recently published the following five brochures:—

1. "Electrostatic Precipitators – Terminology" (Publication No. EP1). This brochure defines the terms used throughout the industry and illustrates the component parts which comprise an electrostatic precipitator.
2. "Electrostatic Precipitator – Proposal Evaluation" (Publication No. EP2). As the title implies, this publication advises the user how to assess and compare different tenders submitted by suppliers in respect of cost, technical content and extent of supply.
3. "Fabric Collectors – Proposal Evaluation Form" (Publication No. F2). This brochure provides a similar assessment and evaluation service in respect of tenders for Fabric Collectors.
4. "Dust Collectors – Proposal Data List" (Publication No. G2). This publication records the basic data which are required by suppliers in order to assess a customer's requirements and to submit the most economic and technically appropriate proposals.
5. "Industry's Tools for Air Pollution Control" (Publication No. G1). The basic types of gas cleaning equipment are described in this brochure together with some simple guidance as to the ranges of particle size for which each is applicable.

Further publications are planned covering other aspects of this broad subject. The above brochures may be obtained from the Industrial Gas Cleaning Association, Dickens House, 15 Tooks Court, London, EC4A 1LA. (Tel: 01-831 7581), price 25p each, or a set of four for £1·00.

As a further service to potential users of gas cleaning plant and equipment the IGCA has recently appointed a Technical Officer. He will help by routing inquiries to members of the Association most likely to be of service and thus expose the user to the collective wealth of experience which has accrued through many years.

Apart from its services to users and potential users, the IGCA also acts as a liaison between industry and the Government and other authorities now concerned with environmental pollution, and so contributes to the increasing effectiveness of pollution control within the United Kingdom.

The IGCA is recognised by its counterpart in the United States of America, formed several years earlier, and is in touch with other countries where the founding of similar Associations is under active consideration. In this way it is hoped that future years will see a developing international liaison between groups in many countries who recognise the vital importance of this field and share the same aims as the Industrial Gas Cleaning Association.

TRADE DIRECTORY AND BUYERS' GUIDE

Alphabetical Listing

For Classified Entries see page 168

AAF Ltd.
Head Office and Works, Bassington Industrial Estate, Cramlington, Northumberland NE23 8AF. Tel: Cramlington (067 071) 3477.

International leaders in products and systems for air pollution control, air filtration, heating, ventilating and air conditioning and noise pollution control.

Allaway Acoustics Ltd.
230 Holloway Road, London N7 8DA. Tel: 01-607 3345/6, 01-607 0189. Telex: 28604. Telegrams: Allacoust London N7. Regional Office: 11 Albert Street, Birmingham 4. Tel: 021-236 008.

Wide range of noise and vibration control equipment including silencers, sound proof doors, enclosures, vibration isolators, etc. Consultancy services and site surveys of noise and vibration undertaken. Full acoustical instrumentation held.

Ambuco Division of Esmil-Envirotech Ltd.
Station Road, St. Neots, Hunts. Tel: Huntingdon 73461. Telex: 32111.

Analysis Automation Ltd.
Cherwell Boathouse, Bardwell Road, Oxford OX2 6SR. Tel: (0865) 53713/59020/511851. Telex: 837509 Analysis Oxford.

Analysis Automation specialises in analytical instruments and has the most comprehensive range of detecting and monitoring equipment available in Britain. Analysis Automation Limited both manufactures and imports instruments. Complete systems for air quality, emission monitoring, water quality and effluent monitoring are built in Oxford. Many analysers are available for long or short term hire.

Analytical Instruments Ltd.
Green Lane, Fowlmere, Royston, Herts SG8 7QS. Tel: Fowlmere (076382) 317. Telex: 81612.

Analytical Instruments Ltd. are specialists in the design and manufacture of ultra sensitive gas leak detectors. These detectors may be used to determine exact positions of leaking toxic materials and hence prevent environmental pollution at its source. They may also be used in conjunction with non-toxic tracer gases as a method of plotting movements and origins of airborne pollutants.

Aveley Electric Ltd.
Roebuck Road, Chessington, Surrey KT9 1LP. Tel: 01-397 8771. Telex: Avel London 928479.

Aveley Electric Ltd. are exclusive representatives for Rohde & Schwarz and Production Measurement Corporation Products.

This comprehensive range of products enables the detection, measurement, analysis, correction and monitoring of all noise and vibration related problems. All the noise and vibration instruments conform to recommended standards.

Rohde & Schwarz also have considerable experience on systems for monitoring the quality of air on a national scale.

Babcock & Wilcox (Operations) Ltd.
165 Great Dover Street, London SE1 4YB. Tel: 01-407 8383.

Babcock & Wilcox Ltd. is an organisation with subsidiary and associated companies throughout the world. It designs, manufactures and erects complete steam-raising plant operating with fossil or nuclear fuels, and also supplies incinerating equipment.

Bacterol Ltd.
115 Lavender Hill, Tonbridge, Kent TN9 2AY. Tel: Tonbridge (073-22) 3188. Telegrams: EVERYSAN, Tonbridge.

The word 'Bacterol' has for many years been well known in health circles, being associated with air disinfection and odour pollution control, sterilising and fumigating products and equipment. Enquiries under all these and related headings will be welcomed.

John Bass Ltd.
Bassaire Building, Duncan Road, Swanwick, Southampton SO3 7ZS. Tel: Locksheath 4060 and 4363. Cables: Bassaire, Southampton.

John Bass Ltd., manufacturers under trade names "Bassaire", "Laminair" and "John Bass Ltd", offer a wide range of clean air equipment comprising—clean rooms, operating theatres, sterile rooms, laminar flow cabinets, modules and fan/filter modules together with air conditioning, ventilating and ducting services.

F. E. Beaumont Ltd.
Rathgar Road, London SW9 7ER. Tel: 01-274 4066.
Woodlands Road, Mere, Warminster, Wilts. BA12 6BT. Tel: 074-786 481.
28 Birmingham Street, Oldbury, Warley, Worcs. B69 4DS. Tel: 021-552 2039.

As well as expanding their industrial chimney business Beaumonts are now producing a device known as the Beauvent G.S.C. which prevents most of the unburnt solids produced in oil fired burning from being emitted into the atmosphere. The G.S.C. can be fitted into the base of any new Beauvent chimney.

Bostock, Hill & Rigby Ltd.
288 Windsor Street, Birmingham B7 4DW. Tel: 021-359 5951.

Environmental consulting and laboratory services—industrial effluent, sewage treatment, water quality and treatment, river, sea and air pollution. Services to industry, public utility undertakings, government agencies, local authorities. Consultancy—treatment process design, commission-testing.

Group environmental laboratories: Birmingham, London, Holland, Italy, Singapore.

William Boulton Ltd.
Providence Engineering Works, Burslem, Stoke-on-Trent ST6 3BQ. Tel: 0782-85658.

William Boulton Ltd. is a British company manufacturing a very diverse range of equipment for the process industries. The Schutte & Koerting Division of the company manufactures the 'Koertrol' range of A.P.C. equipment under licence from Schutte & Koerting Company in Pennsylvania and offer a relatively inexpensive but very effective solution to pollution problems. The Koertrol equipment operates on the wet collection technique and gives very high removal efficiencies.

F. Brauer Ltd.
Grove Road, Harpenden, Herts. AL5 1PZ. Tel: Harpenden 5288. Telex: 825907 Brautool Harp.

Buell Ltd.
George Street Parade, Birmingham B3 1QQ. Tel: 021-236 5391. Telex: 338458.

B.V.C. Limited
Ermyn Way, Leatherhead, Surrey KT22 8TZ. Tel: Ashtead 76121. Telex: 28134.

Manufacturers of a range of industrial vacuum cleaners specifically designed with high efficiency filtration to comply with exhaust emission levels as laid down in 1969 Asbestos Act and also ideally suited for handling many other toxic dusts.

Manufacturers of a range of multi-stage impeller blower and vacuum units from $\frac{3}{4}$ h.p. to 120 h.p. drive capable of supplying clean non-pulsating air within the medium pressure/volume range for applications throughout industry.

Low volume fume extraction units designed to collect and separate visible particulate fume from a welding process for exhausting back into working environment. The unit having high efficiency replaceable and washable elements with ancillaries available for removing gases.

C. F. Casella & Co. Ltd.
Regent House, Britannia Walk, London N1 7ND. Tel: 01-253 8581. Telex: 261641.

Manufacturers of instruments for sampling industrial air pollution, including dust, gases, chemicals, fumes, SO_2, bacteria and spores; also meteorological instruments and humidity indicators and recorders.

Castle Associates
Redbourn House, North Street, Scarborough YO11 1DE, North Yorkshire. Tel: 0723 66348. Telex: 527244. Cables: Electronic Scarborough.

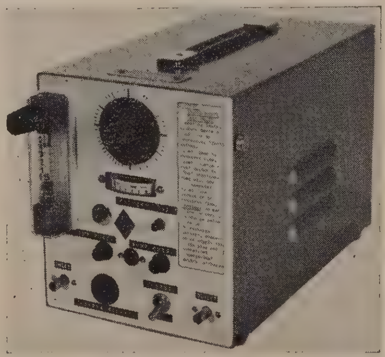
Castle Associates manufacture a comprehensive range of acoustic measuring instrumentation including precision and industrial sound level meters, recorders, filters, switches etc.

Specialised equipment is also manufactured to meet the requirements of legal noise measurements undertaken by local authorities. Tough low cost equipment for factory use is also a speciality.

R. M. Catterson-Smith Ltd.
Woodrolfe Road, Tollesbury, Essex. Tel: Tollesbury 342.

Electric resistance furnaces (450°C to 1750°C) in standard styles and sizes and also 'specials' to meet individual requirements for pottery glass annealing and decoration, stained glass, enamelling, laboratory processes, wire annealing, heat treatment etc.

Charles Austen Pumps Ltd.
100 Royston Road, Byfleet, Weybridge, Surrey KT14 7PB. Tel: Byfleet 43224/5. Telegrams: Capumps Byfleet. Telex: 928368.



The F.I. unit illustrated above is normally used with an approved range of sampling devices for taking a quantitative sample of an industrial atmosphere for subsequent analysis. Manufacturers of a range of diaphragm pumps covering flow rates from 0·5 to 70 litres per minute. Further details from Charles Austen Pumps Ltd.

Coalite & Chemical Products Ltd.
P.O. Box No. 21, Chesterfield, Derbyshire S44 6AB. Tel: 0246 822281/9. Telex: 54250.

Coalite & Chemical Products Ltd. manufacture "Coalite" smokeless coal and are Britain's largest independent producer of solid smokeless fuel for open fires, room-heaters and boilers.

The Company has three production works in Yorkshire and also one at Bolsover which is linked to "Coalite's" own refinery. "Coalite's" annual production capacity is over two million tons.

Dust Control Equipment Ltd.
Thurmaston, Leicester LE4 8HP. Tel: Syston (053723) 3333. Telex: 34500. Telegrams: Dust Leicester Telex.

Design, manufacture, sale and installation of dust control equipment for industrial process applications. Products include a wide range of dust control filtration equipment including integral fabric unit filters, tubular filters, continuous jet-cleaned filters, self-induced spray wet dedusters, dust control units, automatic filtration systems and custom-built installations.

The Electricity Council
30 Millbank, London SW1P 4RD. Tel: 01-834 2333.
Marketing Dept.: *as above.*

The Council is the central body for the electricity supply industry in England and Wales, responsible for consultation on and formulation of general policy.

The Energy Equipment Co. Ltd.
Energy House, Hockliffe Street, Leighton Buzzard, Beds LU7 8HE. Tel: 05253-78373.

The Energy Equipment Co. Ltd. offer a complete mechanical, electrical and civil engineering design/contracting service with site management in the boiler house/power plant field. Specialists in boiler house design, combustion engineering, steel chimneys and general fabrication work.

Evans, Adlard & Co. Ltd.
Postlip Mills, Winchcombe, Cheltenham, Glos. GL54 5BB. Tel: 0242 602227. Telex: 43316 (Postlip Filter Paper).

Geldia (London) Ltd.
Holland House, Burmester Road, London SW17. Tel: 01-947 0231.

Cleerburn Incinerators are designed to comply with the requirements of the Clean Air Act and are made to British Standard 3813. Cleerburn models range from 10 cu. ft. to 80 cu. ft. from simple M.S.P. construction to Insulated and Refractory lined models with Primary and After-burners. There is a Cleerburn for every waste problem.

Glass Developments Ltd.
47c Sudbourne Road, Brixton Hill, London SW2 5AE. Tel: 01-274 4041.

Hall-Thermotank Products Ltd.
Registered office: Vauxhall Bridge Road — Hall-Thermotank Products Ltd., 242 Vauxhall Bridge Road, London SW1V 1AU. Tel: 01-828 5381.
Head office: Dartford site—Hall-Thermotank Products Ltd., Hythe Street, Dartford, Kent, DA1 1BU. Tel: Dartford 23456. Telex: 25594. Cable: 062 Hallford London.
Chapelhall site: Hall-Thermotank Products Ltd., Roseberry Road, Chapelhall Industrial Estate, Chapelhall by Airdrie, Lanarkshire, LN6 8TU, Scotland. Tel: Airdrie 51141. Telex: 779369.
Govan site: Hall-Thermotank Products Ltd., Helen Street, Glasgow, G51 3HH, Scotland. Tel: 041-445 24. Telex: 77616.

Hall-Thermotank Products Ltd. design, manufacture and market industrial refrigeration and air conditioning products from their Dartford (Kent), Chapelhall (Airdrie) and Glasgow factories. J. & E. Hall and Thermotank, the forerunners of Hall-Thermotank Products Ltd., were pioneers in the worlds of refrigeration and air conditioning, and the company is still one of the leaders in their highly specialised field.

Humidifier Group Ltd.
21 Napier Road, Bromley BR2 9JA, Kent. Tel: 01-464 6515. Telex: 896501.

Humidity and Temperature Control; Air Conditioning: Anti-Pollution and Environment Control; Free consultancy and design service on industrial, commercial and domestic applications.

Industrial Acoustics Co. Ltd.
Walton House, Central Trading Estate, Staines, Middlesex TW18 4XB. Tel: Staines 56251. Telex: 25518. Cables: Indcoustic Staines.

Industrial Acoustics Company have 25 years experience in the design, manufacture and installation of all forms of noise control equipment. This includes services to general industry, aviation silencing equipment, air conditioning, noise control and chambers for providing controlled acoustic environment for Medical examination.

The company also operate a noise investigation service and will undertake projects from the investigation to the complete noise control system installation stage.

International Environmental Bureau for the Non-Ferrous Metals Industry
c/o BNF Metals Technology Centre, Grove Laboratories, Denchworth Road, Wantage, Oxfordshire, OX12 9BJ. Tel: 023 57 2992. Telex: 837166.

The Bureau studies the air pollution problems in the non-ferrous metals industries and provides to both members and non-members consultancy services and fume monitoring facilities in connection with all aspects of metal melting and processing.

Johnson Matthey Chemicals Ltd.
Orchard Road, Royston, Herts SG8 5HE. Tel: (0763) 44161. Telex: 817351.

Catalytic incineration of the organic content of process off-gases for odour abatement and energy recovery by means of Honeycat^{R} Air Pollution Control Systems. Catalytic reduction of nitrogen oxides from nitric acid plant tail gases. Catalytic exhaust purifiers for diesel engines and for cars to meet U.S. and Japanese emission standards.

Lee, Howl & Co. Ltd.
Head Office and Works: Alexandra Road, Tipton, West Midlands DY4 8TA. Tel: 021 557 6161. Telex: 338945.
London Office: 375a Regents Park Road, Finchley, London N3 1DE. Tel: 01-346 5994.
Branch Offices:
Crusader House, St. Stephens Street, Bristol BS1 1EL. Tel: Bristol 27241.
4 Heysbank Road, Disley, Cheshire SK12 2BJ. Tel: Disley 3728.
6 Greenrigg, Seaton Sluice, Whitley Bay, Tyne & Wear NE26 4HN.
160 Hope Street, Glasgow C2.
Hollywell Road, Cliff Gardens, off Brant Road, Lincoln.

Manufacturers of all types of pumps and pumping equipment.

Lodge-Cottrell Ltd.
George Street Parade, Birmingham B3 1QQ. Tel: 021-236 3388.

Lodge-Cottrell Ltd. provide complete Gas Cleaning Plants for the removal of dust and fumes from gases resulting from industrial processes and in particular those emanating from cement manufacture, iron and steel production, power generation from solid fossil fuel boilers and municipal incineration.

Lyon & Pye Ltd.
543 Prescot Road, St. Helens, Merseyside WA10 3BZ. Tel: St. Helens 20925. Telex: 627985. Sales Contact: Mr. G. H. Morrison, Sales Manager.

Smokeless Incinerators complying with the requirements of Clean Air Acts for the complete combustion of plastic, rubber, oil and chemical wastes.

All units produce hot water which can be used for other purposes.

May & Baker Ltd.
Dagenham, Essex RM10 7XS. Tel: 01-592 3060.

A wide range of odour-control compounds is manufactured and supplied under the name 'Alamask'. These compounds are extensively used to control malodours in a variety of industries, for example in sewage and refuse disposal, animal by-products, food manufacturing and foundry resins, as well as for problems from the spreading of farm manure slurries and from miscellaneous effluents.

Medical & Biological Instrumentation Ltd.
12/14 Baker Street, London W1M 2HA. Tel: 01-935 0631, 8393. Telex: 261034. Cables: MEDIBI Ashford, Kent.

Suppliers of negative ionisation equipment, particularly for the control of air quality in enclosed spaces.

Range of equipment available for domestic use, offices, factories or computer rooms. Special installations devised for hotel and public service industries. Ion count advisory specialists.

Midland Oil Refineries Ltd.
Shelah Road, Halesowen, West Midlands B63 3PN. Tel: 021-550 4251.

Midland Oil Refineries Ltd. specialise in the batch re-refining of neat industrial mineral oil lubricants including hydraulic, cutting, quench and others. The re-refined oil is guaranteed to an equivalent of the new oil specification. Also used chlorinated solvents are purchased and redistilled.

MOR Effluent Treatment Company
Shelah Road, Halesowen B63 3PN, West Midlands. Tel: 021-550 4251 (10 lines).

MOR Effluent Treatment Co. manufacture and market a range of easy to operate, economical to use, soluble oil treatment plant. The range includes fully automatic continuous treatment, semi-automatic batch treatment and small portable batch treatment plant. No volume of waste is too large. The treated water can be disposed to sewer and the oil may be reclaimed.

Modern Air Systems (Leicester) Ltd.
Barkby Road, Leicester LE4 7LG. Tel: Leicester 766316/7/8.

Nailsea Engineering Co. Ltd.
The Grange, East Park Road, Blackburn BB1 8AT. Tel: Blackburn 63911.

Manufacturers of dry and wet dust control equipment. The Nailsea range includes "Pnu-Jet" reverse pulse bag filters; variable-throat Venturi scrubbers; and "Rainmaster" wet suppression equipment. Applications particularly in mining, quarrying and road stone preparation. Nailsea installations carry the guarantee that they will cope with the requirements of the Alkali Acts.

Nalfloc Ltd.
P.O. Box No. 11, Northwich, Cheshire CW8 4DX. Tel. Northwich 75301. Telex: 66-8663.
Local Offices at: Belfast, Bournemouth, Chester-le-Street, Glasgow, Keighley, Leamington Spa, London, Manchester, Sheffield, Swansea.

Nalfloc Limited was founded by the association of the former 'Alfloc' Water Treatment Service of ICI Limited and the Nalco Chemical Company.

Nalfloc provides a wide range of services, equipment and specialty chemicals for water and effluent treatment, for paper making, for the metal industry, for the marine world, and for general process uses throughout industry.

National Carbonising Co. Ltd.
Fullarton Lodge, Crow Hill Drive, Mansfield, Notts NG19 7AZ. Tel: Mansfield 22644. Telex: 377142.

National Carbonising Company is the parent company of N.C.C. (Rexco) Ltd., manufacturers of Rexco smokeless fuels—Rexco Multi-Purpose, Rexco Nuts, Rexco Superbrite (Rexcobrite in Scotland), with plants in Nottinghamshire, Leicestershire and at Comrie in Scotland. Also N.C.C. (Coke) Ltd., manufacturers of blast furnace and industrial cokes and domestic Rexcoke, with plants at Barnsley and Rotherham.

Newell Dunford Engineering Ltd.
Newell Dunford House, Portsmouth Road, Surbiton, Surrey KT6 5QF. Tel: 01-398 4262. Telex: 929574.

A member of the Dunford & Elliott Group.

Newell Dunford Engineering's Thermix line is well known in heavy industry. Shrewd engineers who have to cope with really difficult air pollution problems appreciate the full complement of equipment available which includes: Tubix multitubular centrifugal collectors. Airmix wet collectors, Thermix cloth filter dust arrestors, high temperature filters, dust valves, exhaust fans and pneumatic conveying equipment.

C. A. Norgren Ltd.
Shipston-on-Stour, Warwickshire. Tel: 0608 61676. Telex: 83208.
Norgren House, Ram Mill, Gordon Street, Off Broadway, Chadderton, Oldham OL9 9QN, Lancs. Tel: 061-881 2358.

C. A. Norgren Limited. World leading manufacturer of compressed air processing equipment including the new DESIGN CENTRE 'AWARD WINNING' Olympian Plug-in System.

Filters, Pressure Regulators, Air Line Lubricators and associated equipment.

Vacuum Filters, Liquid Filters, Liquid Regulators, CO_2 Regulators.

Fluidic Devices and Systems.

Nu-Way Eclipse Ltd.
P.O. Box 14, Berry Hill, Droitwich, Worcs. Tel: 4242. Telex: 339868.

The wide knowledge and technical expertise gained by NU-WAY ECLIPSE in the field of combustion has been applied to the incineration of solvents and fumes emitted from various industrial processes. This has produced fume cleaning plant incorporating the most advanced thinking in thermal incineration and associated heat recovery equipment.

Oakite Ltd.
West Carr Road Industrial Estate, Retford, Notts DN22 7SN. Tel: Retford (0777) 4191. Telex: 56273.

Manufacturers of specialised chemicals, comprehensive range of treatments for air conditioning units, cooling water circuits, dust extractors etc.; fuel oil additives; full range of water clarifying products including clarifiers for potable water.

Peabody Holmes Limited,
Turnbridge, Huddersfield HD1 6RB. Tel: 0484 22222. Telex: 51306.
London: 17/27 Garratt Lane, London SW18 4BY. Tel: 01-874 6491. Telex: 928632.

Peabody Holmes offer total capability in industrial atmospheric pollution control. This means design, manufacture, erection and commissioning of a fully comprehensive range of plant including electrostatic precipitators, high energy scrubbers, wet arrestors, bag filters and multi-cell cyclones. We also supply incinerators for gases, liquids and solids as well as fuel firing equipment for steam raising boilers.

Phoenix Burners Ltd.
34-44 Tunstall Road, London SW9 8DA. Tel: 01-733 1181.

Nor-Ray-Vac suspended, gas-fired, infra-red radiant space heating system for industrial and commercial buildings features: reliability, high standard of human comfort, flexibility to heat selected areas, ease of installation and future extension, low capital and running costs, freed floor space, safety in hazardous areas, avoidance of condensation and minimum maintenance.

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Pacemakers in Plastics, Seeleys Road, Greet, Birmingham B11 2LP. Tel: 021-773 1331 (10 lines). Telex: 338752.

The Plastic Constructions Group design, manufacture and install in acid-proof corrosion-resistant plastics fume ducting, fume cabinets, PLACON fans and roof ventilators, pumps, valves, scrubbing towers, tanks, tank linings, pipes and pipelines.

G. F. Rider (Process Plant) Ltd.
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Comprehensive waste fired boiler plant, having optional summer time incineration standby oil/gas firing, mechanical firing systems for wood chips, sawdust, sander dust and other vegetable wastes. Storage silos. Extraction systems for existing bunkers.

Rodway & Taylor (B'ham) Ltd.
85-90 Buckingham Street, Birmingham B19 3HU. Tel: 021-236 4027/8.

Design, manufacture and installation of effluent treatment plant, dust and fume extraction, chimneys, process plant.

Rolfite U.K. Ltd.
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rolfite

Rolfite products are based on a patented oil-soluble nitrogenous manganese complex, including solutions and dispersions. They are designed to condition oil for more uniform atomisation, improve combustion, reduce corrosion and air pollution by combustion catalyst. Application is simple and operating economies exceed the cost of fuel treatment for any furnace.

Serck Visco
Stafford Road, Croydon CR9 4DT. Tel: 01-686 3861/9. Telex: 946085.

Serck Visco are environmental control engineers specialising in the design, manufacture and erection of dust collecting, air filtration and evaporative water cooling equipment. The equipment is designed to individual specification using standard modular construction units which enables special equipment to be produced from the most economical production methods possible.

Spencer & Halstead Ltd.
Ossett, West Yorkshire WF5 9AW. Tel: Ossett 5121. Telex: 55201.

SPENSTEAD

Spencer & Halstead, specialists in Air Pollution Control, have a modern range of individual units for controlling dust, fume and mist, plant type filters for large extraction systems and a full filter media service.

Further Spenstead services include noise control and supply of attenuating equipment for virtually all industrial purposes, and water pollution control plant for reducing contaminant in waste water. A complete environmental survey and consultancy service is available to solve all pollution problems.

Sterling Industrial
Chapeltown, Sheffield S30 4YP. Tel: 0741-5-3171.

Airkem (U.S.A.) odour control equipment and products for industrial plant, sewage works, crematoria, hospitals, washrooms etc., are distributed in the U.K. by Sterling Industrial. The range also includes disinfectants and detergent cleansers with odour counteractant properties. Airkem odour counteractants attack mal-odour molecules in the atmosphere and the interaction of the two result in the reduction of the offensive odour to an acceptable level, both quickly and economically. List of products manufactured by Airkem: Cavalier Solidaire Gels; Sentinel; Sentinel V; Guardian; Guardian 2; Musketeers; Cavalier 2; On Guard; Airkem Wick Bottles and Chloroblocs.

Sturtevant Engineering Products Ltd.
Acre Street, Denton, Manchester M34 2AX. Tel: 061-336 4325. Telex: 668679.

Comprehensive range of industrial fans including:

S 200 Series Radialine fans with backward aerofoil blades in tubular housing for optimum performance with straight through air flow. Suitable for heating ventilating and industrial applications.

S 400 Series paddle bladed fans for handling materials in powder or granular form.

SE 500 Series Monogram cast iron fans with radial or curved bladed impeller for diverse industrial applications.

SE 1000 Series forward curved fans for many applications requiring high gas flow at low pressure.

S 8000 Series aerofoil bladed fans for a wide range of industrial uses needing high throughput with low power requirements.

Sutcliffe Speakman & Co. Ltd.
Chemical Plant Division, Guest Street, Leigh, Lancs WN7 2HE. Tel: Leigh 72101. Telex: 67555.

Activated carbon equipment; effluent treatment plants and systems; wet scrubbers.

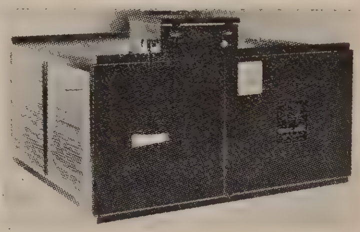
Techmation Ltd.
58 Edgware Way, Edgware, Middx HA8 8JP. Tel: 01-958 5636. Telex: 262245.

Thresh, Beale & Suckling (formerly The Counties Public Health Laboratories)
288 Windsor Street, Birmingham B7 4DW. Tel: 021-359 5954.

Tilghman Wheelabrator Ltd.
Broadheath, Altrincham, Cheshire WA14 5EP. Tel: 061-928 4242. (Air Pollution Control Engineers).

Unit dust collectors, tubular fabric filter dust collectors, reverse jet fabric filters, wet dust collectors. Complete air pollution control systems filter tubes and screens.

UAS (U.K.) Limited
15 Waterloo Place, Leamington Spa, Warwickshire CV32 5LA. Tel: 0926-38390. Telex: 311665.



Subsidiary of United Air Specialists Inc.; manufacturers of the SMOG-HOG industrial electrostatic air filter and air pollution control systems. Self-contained and modular precipitators from 600 c.f.m.-24,000 c.f.m.

Universal Machinery & Services Ltd.
Millshaw, Leeds LS11 8EQ. Tel: 0532-713761. Telex: 557885 (UNIMAC).

Manufacturers of industrial, hospital and marine incinerators. The industrial range includes solid, liquid and sludge as well as material reclamation incinerators. All are designed for low running and maintenance costs and fully comply with the Clean Air Act as well as recent Government recommendations. Heat recovery equipment is also available.

Vokes Air Filters Ltd.
Stephen House, Burnley, Lancs BB11 1PD. Tel: (0282) 38921. Telex: 63267 Vokesair Bnly.

Manufacturers of comprehensive range of air and liquid filters, pipe supports and expansion bellows.

Wellman Incandescent Ltd.
Cornwall Road, Smethwick, Warley, W. Midlands B66 2LB. Tel: 021-558 3151.

Incinerators for gaseous fumes (catalytic and thermal). Incinerators: waste, pathological, municipal, animal, plus special applications.

Dust arresters and sludge removal for cupola melting plants. Cupolas, furnaces, kilns, ovens designed to meet the latest requirements.

Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.
Capitol House, Church Street, Epsom, Surrey. Tel: Epsom 27661. Telex: 23704.

Western Precipitation is part of an international organisation and concentrates on the design, manufacture and installation of electrical precipitators, mechanical dust collectors, dust valves, bag filters and wet scrubbers.

Wimpey Laboratories Ltd.
Beaconsfield Road, Hayes, Middlesex UB4 0LS. Tel: 01-573 7744. Telex: 935797. Telegrams and cables: Wimpeylab Hayes.

WIMPEY LABORATORIES LIMITED
Springfield Road, Hayes, Middlesex
Tel: 01-573 7744

Wimpey Laboratories offer a noise and vibration measuring and advisory service which is operated by engineers and physicists whose experience in this field has been gained by dealing with quality control and design problems in Wimpey and other contracts.

Surveys dealing with pollution of the environment, other than noise, are also undertaken.

Diana Wyllie Ltd.
3 Park Road, Baker Street, London NW1. Tel: 01-723 7333/3330.

"The Air You Breathe" with notes by Rear Admiral P. G. Sharp.

"Air Pollution", parts 1 and 2, by Professor R. S. Scorer.

"Water Pollution", parts 1 and 2, by J. Ian Waddington.

"Energy Conservation", parts 1 and 2, by P. G. Sharp.

"Waste and Re-Cycling" by Tom Burke.

"Noise Pollution" by Dr Keith Attenborough.

All with full lecture notes; some with cassette commentary.

CLASSIFIED ENTRIES

Acoustic Contractors
Allaway Acoustics Ltd.
Industrial Acoustics Co. Ltd.

Activated Carbon Equipment
Sutcliffe, Speakman & Co. Ltd.

Activated Carbons
Sutcliffe, Speakman & Co. Ltd.

Aerators
William Boulton Ltd.

Agitators
William Boulton Ltd.

Air Conditioning Equipment
Hall-Thermotank Products Ltd.

Air Diffusers
Hall-Thermotank Products Ltd.

Air Disinfecting Products
Bacterol Ltd.

Air Freshener Spray Fluids
Bacterol Ltd.

Air Movers
F. Brauer Ltd.

Air Pollution Control
Bacterol Ltd.

Air Pollution Measurement
Analysis Automation Ltd.
Analytical Instruments Ltd.
Bostock, Hill & Rigby Ltd.
C. F. Casella & Co. Ltd.
Charles Austen Pumps Ltd.
Glass Developments Ltd
International Environmental Bureau for the Non-Ferrous Metals Industries.
Techmation Ltd.
Thresh, Beale & Suckling (formerly the Counties Public Health Laboratories)

Analysis Apparatus: Gases
Analysis Automation Ltd.
Analytical Instruments Ltd.
International Environmental Bureau for the Non-Ferrous Metals Industries

Analysis Apparatus/Noise/Vibration
Aveley Electric Ltd.
International Environmental Bureau for the Non-Ferrous Metals Industries

Analysis Apparatus: Particles/Powders
International Environmental Bureau for the Non-Ferrous Metals Industries

Analysis Apparatus: Water
Analysis Automation Ltd.
International Environmental Bureau for the Non-Ferrous Metals Industries
Oakite Ltd.
Techmation Ltd.

Anti-Soot and Corrosion Treatment
The Energy Equipment Co. Ltd.
Nalfloc Ltd.
C. A. Norgren Ltd.
Rolfite U.K. Ltd.

Bacteria Sampling Equipment
C. F. Casella & Co. Ltd.

Blowers
William Boulton Ltd.
B.V.C. Ltd.

Boiler Feedwater Equipment
Oakite Ltd.

Boiler Feedwater Treatment
Nalfloc Ltd.
Oakite Ltd.

Boilers: Industrial
Babcock & Wilcox (Operations) Ltd.

Boilers: Industrial, Solid Fuel
Babcock & Wilcox (Operations) Ltd.

Boilers: Industrial, Waste-Fired
Babcock & Wilcox (Operations) Ltd.
G. F. Rider (Process Plant) Ltd.

Boilers: Packaged, Oil-Fired
Babcock & Wilcox (Operations) Ltd

Brickwork, Boiler Setting
G. F. Rider (Process Plant) Ltd.

Burners: Gas
Babcock & Wilcox (Operations) Ltd.
Nu-Way Eclipse Ltd.
Peabody Holmes Ltd.

Burners: Oil
Babcock & Wilcox (Operations) Ltd.
Nu-Way Eclipse Ltd.
Peabody Holmes Ltd.

Burners: Solid Fuel
Babcock & Wilcox (Operations) Ltd.
Peabody Holmes Ltd.

Catalytic Air Pollution Control Units
Johnson Matthey Chemicals Ltd.

Chimneys
F. E. Beaumont Ltd.
The Energy Equipment Co. Ltd.
Rodway & Taylor (B'ham) Ltd.

Clean Rooms
John Bass Ltd.
Modern Air Systems (Leicester) Ltd.

Combustion Catalysts
Nalfloc Ltd.
Rolfite U.K. Ltd.

Combustion Testing Equipment
Analysis Automation Ltd.

Coolers
William Boulton Ltd.
Hall-Thermotank Products Ltd.

Cooling Towers
Hall-Thermotank Products Ltd.

Cyclones
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Buell Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dampers: Gas-Tight
The Energy Equipment Co. Ltd.

Detectors: Dust
Analysis Automation Ltd.
Analytical Instruments Ltd.
C. F. Casella & Co. Ltd.

Detectors: Explosive Gases
Analysis Automation Ltd.
Analytical Instruments Ltd.

Detectors: Mercury Vapour
Analysis Automation Ltd.
International Environmental Bureau for the Non-Ferrous Metals Industries

Detectors: SO_2
Analysis Automation Ltd.
Glass Developments Ltd.

Detectors: Toxic Gases
Analysis Automation Ltd.
Analytical Instruments Ltd.
Techmation Ltd.

Distillation Equipment
Sutcliffe, Speakman & Co. Ltd.

Dryers
Buell Ltd.
Nu-Way Eclipse Ltd.

Duct Heaters
Nu-Way Eclipse Ltd.

Ducting
Hall-Thermotank Products Ltd.
Modern Air Systems (Leicester) Ltd.

Dust Classification Plant
Buell Ltd.
Nailsea Engineering Co. Ltd.

Dust Collection Equipment
Buell Ltd.
Dust Control Equipment Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.

Dust Collection Equipment & Plant
AAF Ltd.
Ambuco Division of Esmil-Envirotech Ltd.
Dust Control Equipment Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Rodway & Taylor (B'ham) Ltd.
Serck Visco
Spencer & Halstead Ltd.
Tilghman Wheelabrator Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dust Collectors
Dust Control Equipment Ltd.
Modern Air Systems (Leicester) Ltd.
Nailsea Engineering Co Ltd.
Tilghman Wheelabrator Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dust Collector Filter Media
Modern Air Systems (Leicester) Ltd.
Spencer & Halstead Ltd.
Tilghman Wheelabrator Ltd.

Dust Sampling Epuipment
Analytical Instruments Ltd.
C. F. Casella & Co. Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Dust Suppression Equipment
John Bass Ltd.
Nailsea Engineering Co. Ltd.

Effluent Treatment Media
Oakite, Ltd.

Effluent Treatment: Plant/Systems
Bostock, Hill & Rigby Ltd.
Rodway & Taylor (B'ham) Ltd.
Spencer & Halstead Ltd.
Thresh, Beale & Suckling (formerly the Counties Public Health Laboratories)

Effluent Treatment: Soluble Oil Plant
MOR Effluent Treatment Co.

Electrostatic Precipitators
Lodge-Cottrell Ltd.
Peabody Holmes Ltd.
Serck Visco
UAS (U.K.) Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Electrostatic Unit Air Cleaners
UAS (U.K.) Ltd.

Exhaust Purification
Johnson Matthey Chemicals Ltd.

Fabric Filters
Dust Control Equipment Ltd.
Modern Air Systems (Leicester) Ltd
Peabody Holmes Ltd.
Tilghman Wheelabrator Ltd.
Western Precipitation Division of Joy Manufacturing Co. (U.K.) Ltd.

Fans & Blowers
Modern Air Systems (Leicester) Ltd.
Sturtevant Engineering Products Ltd.

Filters: Air
Nailsea Engineering Co. Ltd.
Serck Visco
Vokes Air Filters Ltd.

Filters: Dust
Dust Control Equipment Ltd.
Nailsea Engineering Co. Ltd.
Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.
Spencer & Halstead Ltd.

Filters: Electrostatic Oil Mist
UAS (U.K.) Ltd.

Filters: Water
Vokes Air Filters Ltd.

Flue Dust Extraction Plant
Modern Air Systems (Leicester) Ltd.
Peabody Holmes Ltd.

Flue Gas Dust Sampling Equipment (BCURA Type)
International Environmental Bureau for the Non-Ferrous Metals Industries

Flue Gas Treatment
Oakite, Ltd.
Peabody Holmes Ltd.

Fuel Additives
Nalfloc Ltd.
Rolfite U.K. Ltd.

Fuel Efficiency Advisory Service
International Environmental Bureau for the Non-Ferrous Metals Industries

Fuel: Electricity Supply
Electricity Council

Fuel Oil Combustion Improver
Nalfloc Ltd.
Rolfite U.K. Ltd.

Fuel Oil Conditioner
Oakite, Ltd.
Rolfite U.K. Ltd.

Fuels: Solid Smokeless
Coalite & Chemical Products Ltd.
National Carbonising Co. Ltd.

Fume Removal Equipment
Ambuco Division of Esmil Envirotech Ltd.
F. Brauer Ltd.
B.V.C. Ltd.
Modern Air Systems (Leicester) Ltd.
Nu-Way Eclipse Ltd.
Peabody Holmes Ltd.
Plastic Constructions Ltd.
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Furnaces, Ovens, Kilns, etc.
R. M. Catterson- Smith Ltd.
G. F. Rider (Process Plant) Ltd.

Gas Cleaning Plant
William Boulton Ltd.
Lodge-Cottrell Ltd.
Nailsea Engineering Co. Ltd.
Peabody Holmes Ltd.
Tilghman Wheelabrator Ltd.
Western Precipitation Division of Joy Manufacturing Co. Ltd.

Gas Scrubbers & Washers
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Plastic Constructions Ltd.
Western Precipitation Division of Joy Manufacturing Co. Ltd.

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Babcock & Wilcox (Operations) Ltd.
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Heat Pumps
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Heaters: Infra-Red
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Heating Equipment: Industrial (Space)
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Instruments: Gauges, Meters, etc.
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Industrial Acoustics Ltd.
Spencer & Halstead Ltd.
Wimpey Laboratories Ltd.

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Industrial Acoustics Ltd.
International Environmental Bureau for the Non-Ferrous Metals Industries
Wimpey Laboratories Ltd.

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Lodge-Cottrell Ltd.
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Wet Arrestors
Dust Control Equipment Ltd.
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Newell Dunford Engineering Ltd.
Peabody Holmes Ltd.

NOTES

Sweet smell of success

Success in this case is good relations with your neighbours. And if you are responsible for, say, a sewage disposal plant, hotel kitchen, factory or wherever general industrial malodours occur, good relations are not always easy.

Nobody likes being next to unpleasant odours. And it's not only neighbours that suffer, staff aren't too happy putting up with bad smells all day long.

There is a solution. Airkem Osmix. But it's a vastly different proposition to other so-called solutions. Because Airkem doesn't just swamp a smell with another smell.

It attacks the problem at source through our unique principle of odour counteraction. So the unpleasant smell is neutralized, not covered up.

Different smells need different counteractants. So we have an advisory service to ensure the right Airkem is applied by the best methods at the correct times in the most effective locations.

Airkem Osmix systems are available on rental should you wish to spread the cost of sweet success. Bought or rented, they're a good investment, backed by an efficient country-wide servicing organisation.

Get in touch for details.

AIRKEM OSMIX

Sterling Industrial offers an extensive range of hygiene and floor maintenance products and equipment with the well-known trademarks of Izal, Zalpon, Rozalex, Airkem, Ronuk and Kent Panda. All products you can trust.

Sterling Industrial

Cleanliness at work

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PURE... CLEAN... AIR!

NAILSEA

Britain's best for atmospheric dust collection
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Nailsea Engineering Company Limited
The Grange, East Park Rd, Blackburn BB1 8AT
Telephone: Blackburn 63911 Telex: 63146